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Proceedings of the
FORT UNION COAL FIELD SYMPOSIUM

- Volume 1 -

Table of Contents of all 5 volumes
Cross-reference Index of authors & subjects
Papers of the GENERAL SESSION
Papers of the ADMINISTRATION SECTION

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- table of contents of all 5 volumes.
- a reader's quide to abbreviations.
- cross-reference index of authors and subjects for all 5 volumes.
- papers of the GENERAL SESSION.
- papers of the ADMINISTRATION SECTION.

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* * *

Fort Union Coal Field Symposium

PREFACE

This Symposium was the third such major meeting in Montana in the last decade. The 1964 Coal Resources Symposium was held in Butte on October 9 and 10, with (then) Governor Tim Babcock a major participant. But interest in and even knowledge of the western coal resources were rather small, the actual coal mining activity rather slight, and customers for that coal few and far between.

On November 6 and 7, 1969, the second major Symposium was held in Billings, under the sponsorship of the entire Montana Congressional Delegation and Governor Forrest Anderson. By then both knowledge of and interest in western coal had quickened, and the Proceedings of the 1975 Symposium* contained some 38 papers, on coal mining and exporting techniques, on electrical energy requirements in the west, on the coal and water resource base, on early efforts at land reclamation, on environmental considerations, and on emerging technologies of liquifaction, gasification, and magneto hydro-dynamics. At that time, mine mouth generation was largely in its planning stages in the Northern Great Plains, reclamation research and practise evident in only a few areas, baseline studies of ecosystems almost non-existent, and legislative guidelines relatively few. The tenor of that Symposium was optimistic and cooperative, with a strong sense of there being big things on the horizon, but no real feeling of urgency.

Then, in the years since 1969, the game changed drastically. New laws, new agencies, new tax structures, new towns, new plants, new mines, and new and all pervading crises have come upon us. Many, many more people are seeing their stakes in coal and energy development---for good or ill. Corporate interests have invested many millions of dollars. Intensified exploration has produced staggering figures of the probable coal resource. Severe disagreements have arisen between agencies on the amount and possible uses of water resources. Developments in other parts of the Nation have given some base of knowledge of the effects of massive generating plants. Social impacts favorable and adverse of the current level of coal activity have become evident. Land reclamation questions have been hotly debated. Surface vs subsurface rights are major concerns. Strong polarization of groups has occurred. Every imagineable agency seems to be "in the act" in one way or another. Many research efforts are underway---under corporate, agency, or university funding. And while Federal energy policy (to the extent to which it has been articulated) goes down the road of full exploitation of western coal, a number of the western states (through legislatures, agencies, and citizen groups) have made it abundantly clear that they will not blindly follow the Federal plans---they insist in playing a major decision-making role in determining their destinies.

Because of the intense governmental, corporate, agency, and public interest and concern in energy development and related

*Proceedings of the Montana Coal Symposium, November 6, 7, 1969, at Eastern Montana College, Billings, Mt. Editor; Dr. Wilson F. Clark. 200 pp. (pub Jan. 1970). Those Proceedings are unfortunately out-of-stock and out-of-print, but are in many libraries.

environmental matters, the Montana Academy of Sciences in cooperation with a number of other groups and agencies sponsored, planned, and ran this 1975 Symposium. While broad policy problems and challenges are covered in the General Session papers and in the Administration Section, the bulk of the 78 papers deal with current or recently completed research on aquatic ecosystems, on reclamation, on social impacts, and on terrestrial ecosystems, all as related to various aspects of coal and energy development. We believe this will be a valuable landmark document.

In recognition of the fact that things are happening so rapidly in coal and energy matters, an extreme effort was made to produce these Proceedings in the shortest possible time so that the papers could be immediately useful ---and from conference time to bookstore shelf has been only three and one half months. Further, to overcome the sad fact that most conference Proceedings are decorative rather than really useful---since the reader has only a table of contents as a guide---this publication has a quite thorough cross-reference index (the blue section). And lastly, to offset the penchant of many writers to abbreviate lustily often without explanation or translation for those outside of their immediate fields, a "Readers Guide to Abbreviations" is included (the pink section).

To edit and prepare for publication these Proceedings in the short time elapsed since the conference has been a man-killing chore, but a stimulating experience. My thanks go to the vast majority of authors who cooperated fully and quickly in meeting very tight assigned deadlines. Particular thanks and credit goes to Mrs. Darlene Bayliss of Billings for her remarkably quick and accurate typing, her proofreading, and her cheerful corrections of errors I made.

Wilson F. Clark
Proceedings Editor

Credits: The five cover pen sketches are by Michael Sweeney.
The five hand-lettered covers are by Michael Kosta.

A Reader's Guide to ABBREVIATIONS encountered in the papers of the Coal Symposium.

ARS = Agricultural Research Service (U.S. Dept. Agr.)

BLM = Bureau of Land Management.
B of R = Bureau of Reclamation.
BTU = British Thermal Unit.
BTU/KWH relationship (1 KWH equiv. to 3413 BTU.)

CCN = Cloud condensation nuclei.
CDP = Coal Development Profiles.
CFS or c.f.s. = Cubic ft. per sec.

DEIS = Draft env. impact statement.
DNRC = (Mont.) Dept. of Natural Resources and Conservation.
DOI = Dept. of Interior.

EIS = Env. impact statement.
EPA = Env. Protection Agency
EPS = Energy Policy Study.
EQC = Environmental Quality Council.
ERDA = Energy Research and Development Admin.
ERDA/FE. = Energy Research and Dev. Admin/Federal Energy.

GM = Geometric mean.

KCLA = Known Coal Leasing Areas.
KWH = Kilowatt hour.

LP = Linear Programming.
LPM = Linear Programming Model.

MAES = Mont. Agricultural Experiment Station.
MEAC = Mont. Energy Advisory Council.
MEPA = Mont. Environmental Policy Act.
MEPS = Mont. Energy Policy Study.

NAAQS = National ambient air quality standards.
NAPCA = National Air Pollution Control Administration. (the predecessor of the EPA.)
NDGS = North Dakota Geological Survey.
NEPA = National Env. Policy Act, & N.E. Protection Agency.
NGPRP = Northern Great Plains Resources Program.
NSPS = New Source Performance Standards.

Pa = Probability of intraspecific encounter (complement of PIE).
P.I.E. = Probability of interspecific encounter.
pphm = parts per hundred million.
ppm = parts per million.
psig = pounds per square inch, guage.

SAR = Sodium Adsorption ratio.
SCF/day = Standard cubic feet per day.
SEAM = Surface, Environment, and Mining Program.
SGD = Standard geometric deviations.
SSARR = Streamflow Synthesis and Reservoir Regulation.

TVA = Tennessee Valley Authority.

USFS = U.S. Forest Service.
USGS = U.S. Geological Survey.

WSP = Water Surface Profile.

ZAPS = Zonal Air Pollution System.

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Fort Union Coal Field Symposium

THE STATE'S VIEW OF COAL DEVELOPMENT

Remarks by

Montana's Lieutenant Governor Bill Christiansen

On behalf of Governor Tom Judge, let me welcome our friends from the Dakotas, from Wyoming, from many other states, and from Canada. You might be interested in knowing why Governor Judge is not here today. We flipped a coin to see who would attend here today, and I won. So he had to go the the Bahamas.

At the outset, I wish to commend Dr. Norm Schoenthal of Eastern Montana College, Dr. John McBride of the University of Montana, the Board and Officers of the sponsoring Montana Academy of Sciences, and the five Section Chairmen for their efforts in putting together this meaningful Symposium program with its impressive group of participants.

Thanks too to Dr. Heywood, Eastern Montana College President, for extending the hospitality and the facilities of the college to this Symposium.

Two years ago when I first was appointed chairman of the Montana Energy Advisory Council, I was convinced that very little research was going on that could result in valuable tools for decision-making. I am pleased to say now that there is a substantial amount of research going on, although I am sure the gaps are not nearly filled. I want to commend Ed Zaidlicz of the Bureau of Land Management, and Dan McIntyre of the Custer National Forest for their initiative in launching the Decker-Birney Study.

Montana government has had a strong input into the methodology of that Decker-Birney Study and, although we have not generated all the data we would hope to, I certainly would be much more comfortable if we had the same kind of information on all of Montana's potential coal areas that we have on the 900,000 acre Decker-Birney area. I think that study is an outstanding example of federal-state cooperation. I am sure that the results now available of this and other completed studies, and the further information that is being developed, will be used extensively by the decision-makers at both the state and federal levels when the coal leasing policies are renewed. Certainly they will be used by the Northern Great Plains Resources Program, very capably headed by Dr. John Van Derwalker.

Although in my later remarks it might be construed that the federal establishment is the enemy, this is not true at all and our federal friends can make extremely important contributions in the manpower and budget areas that are beyond the capabilities of the individual states.

My dilemma now is, are there duplications of effort and are the results of these efforts easily retrievable and are they being put to use for their intended purpose?

This Symposium should move toward answering those very important questions.

Fort Union Coal Field Symposium

Today I have been asked to address the topic "The State's View of Coal Development". However, I will exercise my political license and speak of matters which go beyond coal development, pressing as those may be, to issues that will have significant bearing on the future of this state, of this region, and of this nation.

Impressive speakers fill the agenda, and I am sure they will capably address many aspects of coal development. The material I will present deals with more general matters -- policy and planning -- that will affect our response not solely to coal development, but to many of the other significant challenges state governments and the nation face in the future.

I have chosen this topic because I feel that without a formal, working structure to absorb the information that will be presented here, and without a rational scheme of utilizing it, meetings like this are doomed to become only futile exercises.

My remarks will be directed toward two general areas: national responsibilities in energy development, and state responsibilities in energy development.

Energy development in the rocky mountain region places heavy responsibilities upon the Federal Government. Many of the resources underlying our states are federally owned. Most of the development activities foreseen will require federal direction and will occur in areas subject to federal statutes and federal regulatory agencies. These areas of responsibility are immediate and obvious. Actions to be taken by this nation to meet energy needs are critical and require a most thorough exercise of sound judgment. The results of such actions will be pervasive and long lasting. Their effects should focus our attention upon other national responsibilities, no less pressing, but, perhaps, less obvious.

OUR NATIONAL RESPONSIBILITIES

(1) We must make a rational and comprehensive assessment of the problem.

The federal government has not yet indicated that it has completed a comprehensive assessment of the nation's energy crisis. If such an assessment has, in fact, been made, it has not been formally announced and given broad dissemination. True, the government and numerous research organizations have detailed shortages in various energy resources and have projected these shortages into the future. Similarly, a broad range of solutions to these shortages has been proposed. However, these projections and proposals suffer a serious weakness in that they have not been presented in conjunction with a comprehensive analysis of known energy reserves, of related energy and natural resource development and use activities, and, most importantly, of a thorough analysis of the policies and activities that led to our problems in the first place.

Recent national proposals to resolve our energy crisis display a remarkable insensitivity to such analyses, as have been made, and particularly, to consideration of forerunners to our present problems. Such indifferences and omissions must be corrected if the

nation is to truly resolve its difficulties and avoid repeatedly facing them in the future, under even worse circumstances. We have a strong fear that the implementation of recent proposals will only postpone, not preclude our nation's day of reckoning.

This nation's leadership should embark, now, on a course of assimilating and synthesizing the wealth of scientific data accumulated worldwide regarding the availability of renewable and non-renewable natural resources. We must acknowledge that we are dependent upon other nations, not just for fossil fuels, but also for such strategic materials as aluminum, copper, manganese, chromium, mica, nickel, tin and so on. We also must take into account the National Academy of Sciences' concern that the world and this nation may not even be able to feed themselves by the year 2000.

We must seriously analyze the past activities of our nation to determine those events that have produced our present crisis. I suggest that the nation's belief that infinite economic growth is both desirable and possible is foremost among the root causes of our difficulties.

Our infatuation with politically expedient answers that ignore long-range effects is another contributing cause.

Finally, our reluctance to acknowledge natural limits that are placed upon all activities (both by the availability of exploitable resources, and by the limited ability of our eco-system to absorb waste) is yet another facet that bears examination.

While the ability to develop a rational and comprehensive program assessment doubtless exists in many quarters, only a national effort with, of course, strong state and regional input can accomplish the task in the time available to us. Only an open and visible national effort can gain the credibility that such an assessment must have if it is to have any positive effect upon subsequent courses of action.

(2) We must develop specific plans.

Having completed a detailed and comprehensive analysis of our present dilemma, our national leadership must develop specific plans to eliminate or mitigate our problems. Such plans, if implemented, will vitally affect most sectors of the nation's economy and certainly will affect our individual life styles. For these reasons, in contrast to existing proposals, such plans must closely examine secondary and tertiary effects, and project them over an appreciable length of time. Here again, accumulated scientific data must be used, painful as it may be.

Current proposals to resolve our energy difficulties do not reflect careful planning. For example, the Project Independence Blueprint states that the long-term effect of acceleration of domestic oil and gas production will result in a shortage in the future. Even with substantial additions to our national oil and gas reserves, it is expected that domestic production will peak in the mid to late 1980's and rapidly decrease after that date. Despite this, the President has called for dramatic increases in our national production of fossil fuels.

Heavy, long-term reliance upon coal resources as a solution to energy shortages is similarly unrealistic. The Project Independence Blueprint indicates that synthetic fuels derived from coal could supplement oil and gas reserves, but only at the cost of massive growth in coal production and massive consumption of other critical materials, with resulting prices at least three to four times as great as similar products today. The Blueprint indicates that this course would, in turn, result in the rapid depletion of coal resources and the exhaustion of water supplies in some regions. In spite of this, the President continues to call for massive development of the nation's coal resources.

In order to meet the coal production goals of 1.2 billion tons annually by 1985 outlined by President Ford -- in effect a doubling of current rates -- it will be necessary to increase production at an annual rate of 6 percent. Montana's coal production of 8.2 million tons in 1972 increased to 10.7 million tons in 1973--- an increase of over 30 percent. In 1974, production moved to over 14 million tons -- an increase of nearly 40 percent. Anticipated production for this calender year is 20.8 million tons -- an increase of over 40 percent. In relation to the 6 percent annual increase as required by the national production estimates, apparently Montana has already made her share of the nation's quota for the next 20 years. However, Montana still anticipates an annual production of nearly 50 million tons by 1980 if Shell Oil's mining plans proceed on schedule.

Adoption of mandatory energy conservation policies has been shown to encourage the price of present sources of energy to fall below the price levels necessary to accelerate supply. The Blueprint projects that the 1985 price of present sources of energy, assuming compliance with conservation programs, would be below that of the "business as usual" case. For example, natural gas prices with conservation are projected to be 12 percent lower than the "business as usual" prices. Gasoline prices would be approximately 8 percent lower, and electricity costs 1 percent lower with conservation.

Yet, again, national policy now appears to aim at stimulating greater energy production by raising energy prices. We suggest that the nation's energy planners have not taken into account the vast expenditures such resources development will require. Studies show a nuclear power plant must be on line ten years (a coal-fired power plant eight years) before there is a net energy gain. As a consequence, we suggest that crash programs to increase energy supplies be scrutinized using "net energy balance" criteria.

Finally, any plans must be specific in order to insure that they are understandable, debatable and, ultimately, acceptable to the public.

(3) We must consider alternative energy futures.

Rational development of solutions to our current problems should consider more than one "future". Continued annual increases in total energy use is but one of several equally feasible energy futures.

For the first time in the last 22 years, total energy use in the United States declined. I consider this a most encouraging sign, indicative that we do not have to be continuing slaves to exponential energy demand growth. This reduction was accomplished primarily by decreases in the transportation requirements of energy, which constitutes a substantial portion of our total energy requirement. In spite of this pleasant news, our dependence on foreign imports of oil was only slightly reduced since our domestic capacity to produce oil unfortunately fell in much the same manner as the total demand for petroleum products.

The Ford Foundation Energy Policy Project (A Time to Choose), directed by S. David Freeman, presents three feasible national energy futures. These are:

(A) Historical growth scenario -- assuming energy use will continue to grow much as it has in the past.

(B) Technical fix scenario -- assuming a similar level and mix of goods and services, but with a slower rate of energy growth -- about one-half as high as in the historical growth scenario -- resulting from a national effort to reduce energy demand through energy conservation.

(C) Zero energy growth scenario -- assuming a deceleration in demand such that annual energy consumption in the year 2000 would be just over half that required if the historic rates of energy growth were to continue. (100 quadrillion BTU's v. 185 quadrillion BTU's.)

The Ford project maintains that the latter two scenarios are feasible, both technically and economically, without severe disruptions in the quality of life in the United States. I have strong doubts that the historical growth scenario can be considered a viable one in a finite world of finite resources.

The technical fix scenario predicts considerable energy demand reduction by focusing national policy and attention upon efficiency of energy conversion and use rather than upon increasing the supply of energy.

The zero energy growth scenario surprisingly projects somewhat higher levels of employment than those projected in the historical growth scenario, due to a necessary growth in service employment.

At the time the nation is considering various "energy futures", it must develop and put in motion in a comprehensive program of energy conservation. This program must critically examine many aspects of our current way of life and, very likely, suggest some changes in it. This undertaking is also a national responsibility, again with strong state and regional contributions. Individual or state efforts of themselves alone would likely have too little effect, and might work at cross purposes. Too, no state has the capability to develop or the authority to enforce a truly effective conservation program.

Some of the conservation proposals listed by President Ford

in his January 13, 1975, energy message have merit. We suggest, however, that more strigent measures will be required with as close to 100 percent compliance as is possible. Such measures might include more attention to mass transit facilities and less to subsidization of personal modes of transportation. Such measures also should include examination of energy rate structures, with an eye to charging energy consumers the true costs of energy and eliminating the subsidization of heavy energy consumers by small users.

(4) We must make a commitment to preserve natural and social values.

Hard-won environmental legislation recently has drawn increasing fire from industrial interests and some elements within the federal government. It must be remembered that such legislation was enacted with public support in response to obvious needs. The nation cannot afford even temporarily to cast aside its recognition of the dependence of society and humanity upon a healthy eco-system. Any intention to sacrifice natural values in an attempt to quickly solve complex problems long in coming is but another example of disasterous, short-sighted planning.

Recent energy development activities in the west demonstrate that this nation's leadership learned little from the natural and social disasters that accompanied resource development in the east. The social costs attendant to rapid rural energy industrialization in the west have been and must continue to be discussed. National leaders must learn that environmental and social problems cannot be wished away or even eliminated solely by the application of funds. We must learn that the magnitude of some potential problems can only be approximated.

We also must acknowledge that, to date, acceptable solutions to many of those problems have not been demonstrated.

Little of lasting benefit can result from activities that would destroy the social and natural systems that sustain and typify life in the mountain west, and which are also of increasing value to the rest of the nation. Responsible national leaders must seek ways to ensure that energy development is compatible with, not destructive of, these valued systems. This must be reflected in the enactment of legislation that will ensure that energy development activities will be of net benefit to the nation and to this region, when ensure that all costs are computed.

A Federal statute regulating the siting and operations of strip mines is a first and crucially important step. We suggest that other Federal statutes, applying to the siting, construction, and operations of energy conversion facilities, be enacted in the near future. And, we insist that any such statutes reflect the right of individual states to enact more stringent standards of performance, should their citizens so desire.

Additional national commitment to existing natural and social values is necessary. Programs and funds must be created to credibly research and define alternative energy sources and development impacts, to derive solutions to such impacts, and to provide funds for the mitigation of those problems that can be corrected.

(5) We must make a commitment to public access and information.

Recent national events should have taught us that exclusion of the public and its elected representatives from the decision-making process can lead to disaster. If nothing else, these events have taught citizens to be even more suspicious and cynical of their government. Resolution of the present energy crisis, and impending crises, can be achieved only with public understanding, acceptance and support.

These components will be extremely difficult to obtain if current patterns of energy planning and decision-making persist. Neither the public nor other levels of government can operate constructively in this crisis if their access to decisions is limited to vague and often self-contradictory press releases and public meetings. Nor can the system of government act properly when one branch or level attempts to operate independently of the other.

Our national leaders must regain a belief in the ability of the american people to act rationally and responsibly. Such leaders must always remember that they are elected to employed solely to serve the public. They must recognize that the best interests of the public are perceived better by that public than by various special and corporate interests. The energy crisis impinges most heavily upon the public. And it is the public that must be consulted if the crisis is to be resolved.

In order to achieve vital public input and cooperation, the federal government and the national leadership must open the analytic, planning and decision-making processes to public scrutiny. They must certainly inform the public and other levels of government before decisions are made. They must seek the input of the public and its representatives, and use that input in reaching decisions.

President Ford very commendably urged our nation to become a source of world technological assistance and leadership. Let us rise to this challenge by becoming an acceptable model for those nations also suffering energy and materials crises. Rather than repeating the mistakes of the past, let us embark upon a rational course that holds promise for future generations, here and abroad.

SOME STATE RESPONSIBILITIES

Just as there are implicit national responsibilities in energy development and use, so are there pressing state responsibilities. All people here at this Symposium can doubtless detail a long list of specific state actions that must be taken if energy and coal development are to proceed in an orderly fashion. However, in the remainder of my time, rather than listing these actions, I will briefly discuss other state government obligations which have been receiving too little attention.

(1) State governments must make a concerted and comprehensive effort to better inform the public of the nature and severity of our society's energy crisis. While immediate shortages of gasoline and heating oil are temporarily resolved by

immediate programs of reallocation, the greater challenge goes unaddressed. The hard, cruel fact is that our society, and those of other industrialized nations, is fast approaching the finite limits of our conventional energy reserves. History will record that this nation has already consumed more than half of all the petroleum and natural gas we have ever discovered, or will discover on this continent or off its shores. These reserves will be depleted, insofar as a significant dependable supply of fuel is concerned, by the year 2000. Many of these reserves, especially oil and natural gas, have far greater potential for society than use as fuels. However, present implicit societal goals and programs practically guarantee that these energy reserves will be depleted as sources of heat. If this end result is to be avoided, substantial changes must be made in the manner in which we live. Yet there is little apparent recognition of this need for change by the news media, by public bodies, and, for that matter, by government programs.

I realize that government spokesmen will accuse me of being unfair, but I defy them to show me a well-articulated and credible program which truly indicates the severity of our difficulties and which proposes to solve them by anything other than superficial variations on the same old theme. This theme, incidentally, has as a central concept the assumption that human endeavors based upon resource consumption can continue to expand indefinitely, if we are willing to undergo a few "temporary dislocations".

I detect little public understanding of the extremely critical dependence of our society upon energy resources. Few publications are readily available to the public that indicate what may happen to this country if we do really run out of energy sources. We have seen small-scale economic indications of what will happen, but these are dismissed as temporary. For instance, I think that the present response of Montanans to the 55 m.p.h. speed limit is a good indication of the public's distorted perception of the severity of the energy crisis and what should be done to meet it. We all know that driving slower saves lives and gas, but as soon as the gas lines ceased, our average road speed moved back toward normal. And, while our own state government urges the nation to conserve energy to spare Montana the ills of unsought development, a legislative resolution urged the federal government to exempt us from the 55 m.p.h. speed limit.

There seems to be a parallel logic in the instance where consumers of all types of public services want the maximum delivery of these services but do not want to pay the taxes required to provide them. "Tax the other fellow, not me", is the common plea. In a like manner, the same irrational logic seems to pervade the life style changes an effective conservation program will demand. "Change the life style of others, but leave mine alone", is the popular slogan.

If we are to make any substantive contribution to resolution of the energy crisis, state governments must not only gain the public's attention, but also educate the public to the range of futures that await us. We also must assist that public in examining and understanding the end results of social goals and

activities in terms of the use of energy and other natural resources. I fear that if this is not done, the final result of all our governmental policies and plans to resolve our energy crisis will be devoid of lasting import.

(2) We must work to ensure that communication with the public works as a two-way street. Public attention to the country's energy ills is a necessary, but not sufficient, condition to their resolution, while real public input in making long-range energy policy decisions is absolutely essential.

We can hardly expect to sustain public attention and commitment to resolving our challenge without providing the public a meaningful role. Further, since whatever is done will involve change for all of us, all who will be affected should be encouraged to contribute to shaping and implementing that change. Conventional widsom, as well as empirical study, says that persons who have helped develop something are far more loyal to and protective of it than persons who have been handed the same thing by someone else. In this respect, I suggest that our state governments marshal the resources necessary to publicly discuss the energy challenge and its ramifications for our nation and our states. I also suggest that our states commit resources to the development of public forums organized to provide essential public input to the review of, and comment upon, the energy policies we must develop.

I have alluded earlier to the magnitude of the changes and decisions that face us. I will repeat that if we are to make these changes and decisions properly, we must develop sensible and specific plans. However, before these plans can be drawn, we must arrive at coherent and consistent state policies relating to energy production and use to guide those plans.

To date, Montana has been fortunate in that a number of excellent statutes have been enacted concerning energy development, economic development and the quality of our environment. However, these statutes have been enacted without the full benefit of a clearly articulated and commonly understood Montana policy of energy growth and development.

Montana government has made some initial progress in developing a state energy policy with our preliminary position paper calling for coal export rather than energy export through the mine-mouth conversion process. This policy was enunciated more than a year ago and has been substantially endorsed by the public---whose policy it really is---in a series of forums when Governor Judge brought government to the people for that public's discussion and comment.

I submit that this lack of policy partially accounts for the failure of other excellent legislative proposals and for the gaps and inconsistencies that exist within our present system of development and environmental statutes. This lack also may account in part for the inconsistencies, duplication, and conflict that are not unique to Montana government. I would like to see Montana government and Montana citizens begin to develop policy goals relating to energy production, energy use, and energy conservation.

Our state must decide how much energy development is acceptable, what form that development will assume, where it should be sited, and the pace at which it is to occur. We also must decide whether our future is best served by becoming an energy exporter, an energy importer, or by attempting to strike a posture close to balance of energy import and export.

A specific policy responsibility we must soon face relates to the designation, by Montana government, of areas of Montana where development of federal coal underlying all combinations of surface ownerships will be acceptable. Similarly, we must designate areas where mining will not be tolerated, and back up our decisions with sound reasoning. This responsibility should be given us by the Department of the Interior when it reopens Federal coal for leasing.

Once adequate data have been gathered and preliminary positions have been outlined, considerable public discussion and debate will be necessary. Given the processes of discussion and debate, we can be better assured that the content and importance of the policy framework that develops will be at least better understood by the public and supported by the majority.

I cannot overstate the importance of this public understanding and support. The external pressures for development in this state from federal and industrial interests is great. This pressure can only increase. Without the benefit of coherent policies, not only will our response to these external pressures be uncoordinated, but we also will have to contend with diverse internal public and governmental pressures.

Beyond the broad public policy issue, there also is a need for an internal state government policy regarding energy use and energy development planning. We can hardly expect our citizens to respond properly to the energy challenge when we have failed to put our governmental house in order. Montana government must develop and enforce uniform programs regulating the use of energy in house. State government's in-house response, motivated by executive direction, in the first year following the Arab embargo, resulted in electrical savings of 7.3 percent and natural gas savings of 7.2 percent. However, the same national affliction, creeping complacency, took over in state government and we are now just holding our own and not showing, as we must, continuing improvement in our heat, light, transportation, and other energy usages. Transportation alone accounts for 25 percent of total energy consumption. Recognizing that, we must develop a better car-pooling policy for in-state travel with state cars and aircraft. Some state programs continue to operate in opposition to other programs urging energy conservation. Montana government has yet to develop a program which will result in the production of reports that summarize all relevant, state-generated data on energy production.

We also have failed to devise means to collect data on energy sales and energy consumption in Montana in a uniform and coherent manner.

Once we have established policy outlines for both the state as a whole and for government operations, we must seriously

follow through in implementation of them. We will be required to commit real funds and real manpower to these matters -- a redirected, catch-as-catch-can approach will not suffice. Further, a failure to follow through will cost us any hope of regaining and sustaining public attention, concern and commitment.

(3) Our state governments face another responsibility. In the interests of maintaining state and regional options regarding self-determination, we must join in a regional common cause. The recently created Regional Governors' Energy Policy Office is an important first step in this direction. The goals of this organization are to determine areas of mutual interest, to define common development policies, were possible, and to mobilize the combined political forces of these states in support of those policies in Washington, D.C. Another goal of the organization is to guarantee common political support of individual state's rights of self-determination in energy development. The creation of this organization was long overdue, and I commend the participating governors for acting to fill this need. I encourage all who are concerned with energy development to support and work with this organization. It does offer our states a remarkable opportunity to shape future events, both individually and collectively.

(4) Finally, there is another responsibiltiy all of us must face, whether citizen, researcher, politician, bureaucrat, or developer. That is the responsibility that can be met only by being willing to confront all issues head on (biting the bullet in current jargon), by being frank in discussion of issues, by developing a sense of perspective that focusses on long-term benefit to all, and by making a commitment to work together toward common goals.

The time of evading sensitive and controversial issues is past. If we fail to realize this, and continue to avoid facing these issues squarely, we are more apt to determine our future by default than by design.

CONCLUSION

Thank you again for this opportunity to meet with you and participate in this Symposium. I know that much valuable information will come from this, and I know that the Symposium Proceedings will be a valuable and much-studied document.

* * *

G-12

Fort Union Coal Field Symposium

NORTH DAKOTA'S VIEW OF COAL DEVELOPMENT

Remarks by

North Dakota Governor Arthur Link

Lt. Governor Christiansen, Governor Herschler's representative, members of the Montana Academy of Sciences, Eastern Montana College Faculty and students, and the many administrative and research people from all parts of the country---

It is my distinct pleasure to be here this morning at this Fort Union Coal Field Symposium along with my fellow governors to talk to you regarding North Dakota's view of coal development. As you are all aware, this topic has been one which has been foremost in the minds of all of us during the last two years. While developing this presentation, it was difficult for me to determine which would be the most important areas to discuss with you this morning. As I review the last year, the past legislative session, and the year to come, it is obvious that a great percentage of our states' time has been and will be absorbed in dealing with coal development. I think I would be remiss if I spent these few minutes reiterating many facts and figures, most of which are very familiar to you. Instead, I have decided to spend the time talking with you about the philosophy that I feel North Dakota and our region must adopt in order to deal with the national energy crisis.

The first part of this philosophy, which I feel is on its way to being established, is something I would like to refer to as "New Regionalism."

During the past year we have seen a great number of events take place that have brought our state and this region closer together both physically and philosophically. It is heartening for me to note that on at least two occasions legislators from three states have gathered together to discuss developments in coal legislation. I know from reports of these sessions that they were extremely worthwhile to those legislators who attended from North Dakota. In the past, state-to-state communication of this nature has existed mainly through the Offices of the Governors and through the National Governors' Conference and its regional meetings. This broadened base of legislative, as well as executive, communication will be helpful to interstate relationships.

Very recently an even more extensive communication proposal has been submitted to the National Science Foundation by the North Dakota Legislative Council. This proposal is entitled the Organization of a Four-State Conference and Resulting Mechanism for Interstate Cooperation Relating to the Development of Natural Resources in the Fort Union Coal Formation. At last we are now bringing together both branches of our states' governments plus research people to cooperate in regional problems ---problems that cannot be dealt with by one state alone.

Another organization which has been in existence for several years, but which has recently developed a significant role

in helping the states with their energy problems, is the Old West Regional Commission. I must applaud those people who have so diligently worked during the last year to try to meet the needs of the states who are members of the Commission. Enormous efforts have taken place in funding reclamation studies, socio-economic impact studies and energy-study aspects of governors' offices, so that the states may more adequately meet the future problems presented to us by energy development. This cooperative relationship of federal agencies, state agencies, and state governors has proven to be a new beginning toward communication that has not existed in the past.

Finally, and of greatest significance, is the development of our new ten-state compact, the Western Governors' Regional Energy Office. In this effort we have not only unified our own North Central and Western States, but have stepped outside of our borders to include areas with similar problems located in the southwestern United States. This type of broadened regionalism is something only a few imagined possible a short time ago, but to which many now are looking with great anticipation, for the leadership it can and will assume.

No single force can have as great a power as that produced by unifying a major portion of the central United States. The step has been taken to make this a voice which will be heard in Washington. It is now up to those of us who formed this body, the Governors, to make sure that it is a successful one.

These steps are the beginnings of a new, close relationship, a"New Regionalism." This last year has allowed us to see that each of our states cannot stand by itself, but is responsible to our neighbors. Decisions that are made in Montana and Wyoming are bound to affect North Dakota, and decisions made in Colorado, New Mexico and Utah must also be considered important to the northern states. Answers to energy problems and coal development cannot take place just within our own borders. We have begun to step outside these boundaries and listen to, talk with, and discuss with our neighbors problems that affect all of us. As I view coal development in North Dakota, it is philosophy of "New Regionalism" which I feel must continue to develop.

We have come a long way in establishing a new regional approach, but along with this must also be established a "Philosophy of Cooperation." There are too many problems which exist in the development of our coal in the Fort Union Region to feel that independent decisions can be made that will not affect other states. One of these issues, which must have many hours of cooperative thinking, is in the area of water. At the present time, and I hope for years in the future, there will be adequate water flowing through each of our states to allow us to develop both the agricultural and industrial potential that each state desires. This is an area where there must be cooperation, and may have to be compromise. It is North Dakota's position that our first priority must be to assure adequate water for the agricultural industry of our region. This has been our mainstay for years and will continue to be an important mainstay for the nation as food shortages increase. Each state must be aware of the others' thinking on issues such as these: What level of development will a state accept? What will be the balance

between the exporting of coal and the development of on-site conversion facilities? How much diversion and out of what area will diversion of water for these facilities take place?

We know first-hand from the Colorado River development that no state can deal with a water resource without affecting its neighbors. We must have a state-to-state philosophy of cooperation.

We must also have a state-to-federal philosophy of cooperation. Personally, I do not feel we can take the agressive role of near-secession that some people feel is necessary. That does not mean that we cannot stand firm in our positions over the bargaining table, but we must be present at that table. We must be partners in the decisions that are being made in shaping the energy needs of our nation. A perfect example, which illustrates the need for this type of cooperation, is the split mineral and surface ownership problem present in all of our states.

Let me digress for a moment and give you a few figures that will illustrate the magnitude of this problem in North Dakota. At the present time, in our western-most twenty-eight counties which contain most of the known coal deposits of the state, there are 5.4 million acres of Federally owned minerals. In contrast to this there are 1.9 million acres of Federally owned surface lands. This results in approximately 3.5 million acres left that have a split ownership, the federal government owning the mineral estate and either corporate (largely railroad), state, or private entities owning the surface.

Let me illustrate the problem even more dramatically. In the counties of Mercer and Oliver where the majority of our coal development is scheduled to take place, there are 254,460 acres of Bureau of Land Management administered minerals with only 733 acres of Federal surface ownership. The remaining 253,727 acres have private, railroad or state surface ownership with Federal mineral estate ownership. With these types of land ownership conglomerations confronting us I don't think anyone can argue with the need to develop a cooperative relationship among the parties that will be involved in developing this resource. It appears to me if national needs for energy continue to grow and if states are unwilling to negotiate for the type and amount of development they desire, that the Federal Government will demand and consequently mine the needed resources for our nation. Once again, we must be a party to all decisions that are being made in our states and in our region. In this case I am convinced that an antagonistic attitude will not lead to a fair and just solution.

In the last several months I feel North Dakota has established this position of cooperation with federal agencies. Most recently we have signed a memorandum of agreement with the Bureau of Land Management. This memorandum establishes an avenue of communication which allows the state of North Dakota to participate in the decisions being made by BLM as it assesses the Federal minerals in our state. The announcement of the signing of this agreement was made by Secretary Rogers Morton at the January Denver meeting with the Western Governors. Secretary Morton indicated his pleasure with this tpye of action which

committed both federal and state officials to a cooperative effort. We have become partners in the decision-making process, not just listeners at a hearing scheduled after the decisions have been reached.

I think it is fair to say that this region will continue to feed the nation, both with its agricultural produce and its natural resources. I think it is also fair to say that we will meet the commitments that we have to the nation in both of these very important areas. But, a state must be allowed to either make the decisions itself, or be an integral part of the decision-making process of how and where we will meet these commitments. Recently at a meeting in Washington of the Natural Resources and Environmental Management Committee of the National Governors' Conference I expressed what I feel is a simple request of the federal government. I asked that before any decisions are made with regard to our western states: (1) that an inventory of all of our resources be established; (2) that an inventory of national needs of all these resources be made; (3) that a national allocation of these needs be established that is reasonable for each state to assume, and (4) that states be allowed to plan for these allocations and responsibilities. This four-step process should be one which would involve public, state, and federal input. It is only through this type of inventory that our region can determine whether it will feed the nation's appetite for food consumption or energy consumption or whether it has a responsibility for both.

In closing, I hope I have been able to express to you some of my concerns, as I view coal development in North Dakota and the region. When the issue of coal development in the western states is so intertwined with national energy needs, national economic needs, environmental concerns for our nation, and indeed even international relationships, it seems impossible to me that solutions can be obtained without establishing two things: First, we must establish a "New Regionalism" where we of this region are in close communication with our neighbors. And second, we must establish a "Philosophy of Cooperation" which will extend to all those who are searching for the answers to problems confronting all of us today.

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G-16

Fort Union Coal Field Symposium

THE IMPERATIVES OF INTERDEPENDENCE

Jack O. Horton

Assistant Secretary of the Interior,
for Land and Water Resources

Three weeks ago I spoke here in Billings to a distinguished gathering assembled for the Western Governors Conference. My remarks then centered around the theme that the traditional values of the West could be preserved and at the same time its energy resources be put into the service for the West and all Americans. I argued also that this theme which would protect the past, while planning a new future, could only be assured if we created an Alliance of Interdependence between Federal and State governments.

At this Symposium I should like to continue and expand upon that theme, by examining current legislative and administrative actions that I feel are moving us toward recognition of our interdependence.

Two pieces of legislation now before Congress will be of high interest to you--the proposed amendments to the Mineral Leasing Act of 1920, and the Strip Mining Bill.

LEGISLATION AFFECTING COAL LEASING

In the late 60's it became apparent that Interior's coal leasing system was not working in the national interest. It put 16 billion tons under lease, but very little into production. It did not assure fair market value return to the people of our country. Nordid the system adequately, or even minimally, protect environmental and land values.

The Administration has been working closely with the Congress to develop amendments to the Mineral Leasing Act that will bring the leasing of Federal coal more in line with current national objectives and priorities. The legislation, H.R. 3265, would amend the Mineral Leasing Act in such a way as to set up an all-competitive mineral leasing system. The bill would require land use planning, with full public participation, for coal leasing. It would strengthen the Department's ability to impose and enforce requirements for diligent development of existing leases. H.R. 3265 would change many of the past procedures of coal leasing. New leases would be for 20 years rather than for an indefinite period. It would allow exploration, under a permit called an exploration license issued by the Department and in accordance with the pending Surface Mining Bill. Mining companies would be required to submit operation and reclamation plans.

The current language of the bill would increase royalties to a minimum of 10 percent as opposed to the old minimum of 4 percent. Since the bill would require that all coal leasing be competitive, it eliminates the difficulties of prospecting permits and preference right leasing. Bonus or royalty bidding could be relied upon to secure fair market value return.

The Senate's bill, S. 391, is very similar to the House bill. The House will probably mark it up this month and the prospects for passage this year, perhaps in mid to late summer, are good to excellent. The Senate bill might follow a month or two after that. I say that, knowing full well that it is very difficult to project what Congress will do or not do about any specific piece of legislation, and I certainly do not know what odds Jimmy the Greek is quoting this week on the prospects for passage. When the Senate bill is passed and is reconciled with the House bill in conference committee, we will have strong legislation to support the integration of coal leasing into a multiple resource decisionmaking system.

STRIP MINING LEGISLATION

As recently as yesterday the surface mining bills passed by the Senate and the House were in the hands of a conference committee. The most serious points still under discussion revolve around water. The conferees are concentrating on protection of the hydrological balance in a mining area. As now written, the bill would create in the Department of the Interior an Office of Surface Mining and Reclamation and Enforcement.

Of special interest to this Symposium, the Act would provide Federal assistance to research institutes in several states to be located at universities with strong mining curricula. Further, through fees on all coal produced, it would set up a reclamation fund in the Federal Treasury to restore abandoned and unreclaimed mined lands, and to provide funds for impacted areas. But the real impact of the bill lies in its provisions to control the environmental effects of surface mining. The legislation would assign to the states primary responsibility for regulating strip mining. The Federal government would provide matching funds for the first 4 years of operation of an approved state plan. Only if a state does not meet its obligation within 13 months after the bill is enacted would mining be regulated under a Federal program.

The bill would require the following performance standards for surface mining on Federal lands:

Mined lands must be returned to approximately their original contours.

Where there is a more than 20 percent slope, spoils cannot be put on the downslope. In other words, no highwall.

The operator must segregate, stockpile and redistribute the topsoil.

He must revegetate the area to conditions comparable to those existing before mining.

He must minimize disturbance to the prevailing hydrological balance, at the mine site and in associated off-site areas.

For surface disposal of mining wastes and tailings, combustible and impervious materials must be buried, the

waste pile must be compatible with its surroundings and such that it can be stabilized and revegetated.

Performance bonds and inspections would assure that these standards are met.

The present bill allows a surface owner to refuse consent to the leasing of the Federally owned minerals under his land, provided he meets one of three conditions: if he has owned the land for 3 years, if he lives on the land, or if the land provides his principal source of income. If a surface owner who meets one of these three conditions consents to mining operations, he will be reimbursed for his loss of income; he will be reimbursed for the value of the surface estate, including improvements, and an additional sum not to exceed $100 per acre; and finally his land will be reclaimed.

ADMINISTRATIVE STEPS TO IMPROVE COAL LEASING

As you know, the Department imposed a defacto moratorium on coal leasing in 1970. Under the Secretary's criteria for emergency leasing, only four leases, in widely separated areas, have been issued since that period. This moratorium has been in effect for 5 years. During the 5 years of the moratorium, the Department has taken a number of steps to correct and strengthen, and to completely redesign the leasing system, to being it in line with the three objectives: higher production, better dollar return, and stronger protection of resource values.

Work on the Programmatic Environmental Impact Statement is nearing completion. Considerable work and analysis has been expended on this document. There is some sentiment in the Department that the statement in its present form should be reissued as a Draft EIS, to make sure that the public has another opportunity to comment on the proposed program.

The proposed system provides the states numerous opportunities to influence Federal decision. Indeed, the process will encourage close Federal-State land planning for resource Development. That's the kind of cooperation necessary for an "alliance of interdependence."

BLM'S LAND USE PLANNING

Proposed coal leasing would be integrated into BLM's sophisticated interdisciplinary land use planning procedures. It is worth a few minutes for me to describe this process. Multiple-use plans are prepared by staff experts in the 12 BLM State and 65 District Offices. The system started in 1969. By last July, at least first generation plans had been prepared for about half the lands under BLM management. Altogether, when the work is completed, each of the approximately 650 planning units will be covered by a Management Framework Plan or MFP.

A planning unit may vary from 100,000 to 6 million acres. The MFP is a blueprint for the optimum management of seven basic resource values or activities--minerals, wildlife habitat, livestock forage, watershed, timber, recreation and intensive land use. Policy guidance sets forth the basic objectives and

policies for National Resource Lands, together with a policy statement for each resource activity. A unit resource analysis begins with preparation of a base map showing surface and subsurface ownerships. Resource data will be shown on overlays. Next, a physical profile discusses climate, topography, geology and soils, vegetation, water resources, wildlife, limiting physical factors, and development. The third step analyzes the present situation for each resource category and includes an ecological profile describing the environmental situation. The last step of the inventory assesses each resource in terms of development opportunities. Social and economic data are cranked into the equation, so that the resources manager can weight the consequences of developing one resource or another, or as is usually the case, several resources together.

The Bureau office, in public meetings and through written comments, solicits from a variety of public groups their ideas, knowledge and proposals for land use.

The preparation of an MFP goes through three steps. In the first, program objectives and recommendations are made for each resource activity without concern for its overlap or conflict with other activities. These later become alternatives or options for the decisionmaker. The second step analyzes the interactions between the seven resource activities, including impacts on social, economic, institutional, environmental and resource values. Where there are major competitive situations, alternative solutions are developed. In the third step, all the data of a Management Framework Plan is reviewed by the State Director or District Manager. He selects and approves a specific alternative. His planning decision indicates areas for development and identifies the stipulations and mitigating measures necessary to protect other resource values.

BLM AND NORTH DAKOTA AGREEMENT

Land use planning is not a one-way Federal street. Many of you will have heard of the memorandum of understanding recently signed by North Dakota Governor Link and BLM State Director Ed Zaidlicz, and Governor Link alluded to it briefly in his address to this Symposium. But you may not be familiar with its details.

BLM and North Dakota have agreed to coordinate their approach to land use studies, and where possible, to coordinate the implementation of management plans and programs. These cooperative efforts will include development of the following items or processes:

(1) Land use study procedures;

(2) Common Data Banks;

(3) Complementary land use planning systems;

(4) Exchange of proposed plans and activities that might affect either party.

(5) Review and evaluation of environmental assessments and impact statements.

The two parties agree to make personnel available for mutual assistance and to cooperate with local agencies in data gathering and land use planning. The agreement, to my mind, represents a big step toward an alliance between State and Federal authorities.

AN EXPORT POLICY FOR COAL?

Energy interdependence between Federal and State Governments is built upon the recognition of several principles:

1. That the nation, in asking energy development of western states, concern itself equally with mitigating adverse environmental and social impacts.

2. That the states, in expressing legitimate concerns about this development recognize both the responsibilities they have to their own citizens and those to the nation.

3. That both levels of government closely join hands in a deliberate, professional land use planning exercise for resource management.

Now there is nothing in Project Interdependence that requires any state to support the construction of any specific number of energy plants. Nor, as far as I know, is there a state constitution that, on principle, would prohibit them. Discussions on plant siting, then, should be made on a case by case basis, within a regional environmental analysis, and should be made in the Governor's Office in Bismarck, or in Helena, or in Cheyenne. . . . . .not in Washington, D.C. One can say, therefore, that the contribution asked of the west for energy resources need not necessarily entail the siting of a specific number of powerplants within any state.

Particularly in arid regions with small populations there exists a solid argument for the export of coal to areas of more abundant water, to areas of available labor forces, and/or to areas where the demand for electrical energy continues to increase.

This policy would:

(1) Achieve important savings of water in those areas where water is short.

(2) Prevent, or vastly simplify, the problems of human impacts by reducing labor force necessary for energy development.

(3) Encourage slurry pipelines and unit trains as export transportation systems which are more easily accommodated in sparsely populated, arid western basins than could the thousands of people needed to build and man electrical generating and gasification plants.

(4) Ask the areas who need the energy to share the environments and social costs of its production and conversion.

(5) Utilize the abundant water resources in these delivery areas - the Great Lakes, Missouri and Ohio River Basins for the much higher water requirements for coal conversion required to produce electricity and liquid fuels.

The Governors of the Western States, together with the Federal Government, should carefully weigh the advantages of exporting coal to outside populated centers rather than importing the water, the labor, the technology and the complex social and economic impacts to areas which are so poorly prepared and equipped to accommodate them. It is clear, of course, that neither extreme---coal totally exported to the outside or coal totally converted within the state---is a possibility. The key lies in balance and in my judgement, that balance can only be determined by the Governor and the citizens of each particular state.

FEDERALISM

The ties of any federation--between country and region--between nation and state--are more than legal and constitutional. They are clearly moral and they extend beyond the state of obligation.

What does the nation owe the states?

What do the states owe the nations?

Lawyers and economists have occupied themselves for centuries with these questions. If they were laid head to head around the world they would never, as they note today, reach a conclusion.

The question is not what we owe each other individually, the question is what we are and what we owe each other collectively.

First, and thank God for this, we are all Americans. We share a common constitution, a government and a country that is second to none. And I for one have enduring pride in that.

Second, we are westerners, sharing as good a land, and water and air as any in the world. This west is part, a very great part, of the Nation and we are proud to share it with all Americans. The central part, the heartland, of this continent became "America" because we opened our doors and hearts to all races, countries and religions. The genius of the American achievement, and indeed the American character, is a result of that amalgam, that diversity and that generosity. And that amalgam and diversity and that generosity is just as inherent in this room tonight as it is in the Nation. While we are all westerners, we are descendents of Poles, Swedes, English, French, Basques, Italians, Chinese, American Indians, and today, it appears for the future, Vietnamese. Indeed there may even be a Texan or two. The diversity and strength of the American westerner is a product of the generosity, the open door policy, of the Nation since colonial days. We cannot, we must not, revoke or repeal that principle. To the contrary, one of the unique characters of the American west since frontier days has been the genuine warmth and hospitality of its people. We have

outdone the nation in one of its highest attributes.

Third, besides Americans and westerners, we are also individuals. A westerner is an individual or he is not a westerner. And any individual in the west recognizes two common-sense principles:

1. The first is that good fences make good good neighbors. . . . . .particularly if the fences are barbwire.

2. The second is that fences aren't worth a hell of a lot--if there aren't any gates.

Now a good many people are engaged in building a fence around the west, forgetting clearly that it was the Nation that acquired the land through the Louisiana Purchase, and it was the Nation that granted land to the states, homesteads to the pioneers, rights-of-way to the railroads, and water to the farmlands. I extend to the Nation no special bargaining posture for these actions. They were part of manifest destiny and westward expansion. But it does say that neither the Nation, nor indeed the west, have become what they are because of closed fences.

I, for one, stand for open gates and open fences.

The one thing a gate allows you to do is to communicate and shake the hand of the guy in the other side. That is about 80 percent of the problem. If each side--the feds and the states talk only to themselves, if the fences remain closed--then the "confrontation" which everyone seems to be discussing will be a self-fulfilling prophesy. If the gates are open then the words become a dialogue, a communication, rather than a confrontation. And the dialogue starts to resolve problems rather than compounding them, and starts to produce solutions instead of defiance.

As Americans, as westerners, as individuals there can be only one intelligent course. If good fences build good neighbors, only open fences can provide the interdependence to keeping them fixed.

True for fences, true for ranches and true for governments.

And that, ladies and gentlemen, is what an alliance of interdependence is all about.

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COAL--SCARCITY AMIDST ABUNDANCE

S. David Freeman*

(Editor's note: Mr. Freeman presented a stimulating, informal address at the Symposium, but did not have a prepared paper. In lieu thereof, he submitted the following exerpt from his book Energy: The New Era (published June, 1974, by Walker and Company).

More than any other fuel, coal illustrates the frustrating dilemma we face with our current energy supplies. At present coal is our most abundant source of energy, but we cannot mine it or burn it in a socially acceptable way.

The size of the U.S. coal resource is roughly thirty times the energy value of our oil and gas inventories combined. Our knowledge of the U.S. coal resource is inadequate, but we know it is so large that we should not be in danger of running out of coal for at least another century. According to the estimate of the U.S. Geological Survey, based on mapping of known fields and exploratory data, remaining coal deposits in the U.S. total approximately 1.56 trillion short tons. Some 200 billion tons of recoverable coal lie within 1,000 feet of the surface in seams at least 3 ½ feet thick. Even this conservative figure of 200 billion tons is huge when compared to a domestic consumption of about 600 million tons last year. It is evident that, in physical terms, a doubling or even tripling of coal consumption could be sustained far into the next century. It must be emphasized, however, that these are quantities of coal in the ground and are not proven reserves. The coal industry, unlike the oil and gas industry, does not maintain a nationwide inventory of discovered reserves, and there are no figures for coal comparable to the discovered reserves for oil and gas.

The truth of the matter is that no one knows who owns America's coal resources or how much is really available at any given price. Just as in oil and gas, there are no supply curves. The figures on total coal resources, however, are fairly reliable because estimates are based on outcrops and other tangible evidence.

There are many obstacles in the way of the rapid development of this abundant resource. As noted in the previous chapter, the underground mining of coal is the most dangerous occupation in America today. The Coal Mine Health and Safety Act of 1970 attempted to remedy these abuses, but in doing so it has added considerably to the costs of underground mining and, therefore, to the state of uncertainty already existing as to future supply.

For these reasons, strip mining has become much more economically attractive and has been steadily increasing its share of the coal market, producing some 258 million tons in 1973, up from 165 million in 1965. Strip mining now accounts for about 50 percent of current production. The strippable coal represents

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only some 10 percent of the total coal resource but it may well represent a much higher share of the U.S.'s economically recoverable coal.

The pace at which we make use of our coal resources will be determined in large measure by our ability to develop technology and skills to mine, process and consume coal cleanly. But the shortage of skilled labor and long lead times for opening new mines are not to be ignored. The location of the remaining coal resources is another factor that will influence future use of the fuel. The overwhelming bulk of the coal until now has come from Pennsylvania, West Virginia, Illinois, and, to a lesser degree, Kentucky. In the last twenty years these states have accounted for 70 percent of U.S. production.

The remaining reserves of these eastern states -- primarily deep-mine coal -- are still quite substantial, yet it is important to know that there is more coal west of the Mississippi than to the east and that the importance of western coal will grow in the years to come. The large western coal fields are low in sulphur content and are currently attractive because their coal complies with air pollution standards. But they are lower in heating value than eastern coals and this disadvantage is compounded by the fact that they are located far away from the major consuming regions.

Coal is expensive to transport. In order to comply with air quality standards, some utilities are bringing coal 500 to 1,000 miles from the Rockies to the industrialized east, thus paying double the delivered cost of coal from nearby eastern mines.

The importance of western coal will nevertheless grow in the coming years. Having lost many markets to gas and oil, coal will soon outlive these more scarce resources and can regain these markets through technology that converts coal to synthetic oil and gas. Coal-gas or coal-oil plants located near the mines could then pipe synthetic gas or oil to consumers in other parts of the country much more economically than transporting the coal by rail. Perhaps of even greater long-range importance, the coal reserves in the east and the west are a unique combination of hydrocarbons which, not unlike petroleum, can serve as raw material for the rapidly growing petrochemical industry. But these uses must await new technology.

An important additional factor contributing to the uncertainty surrounding the availability of coal supplies is the ownership of our coal resources. Much of the remaining coal resource in the east is owned privately, and many of the most promising tracts are in the hands of the steel industry and other private interest holding them for future development. Recently oil companies have acquired billions of tons of coal reserves in the east and the west as well.

Coal is America's resource giant in a straitjacket. The shortage of natural gas and the slumping domestic oil industry have created an energy vacuum which coal could easily fill. But coal, the filthy villain of the industrial era, is still part of the problem instead of the solution.

Five to ten years ago, anyone in public life opposing projects to exploit our resources or build new industrial developments would be committing political suicide. At that time, anyone proposing to exploit the coal resources in Montana and other western states would have been greeted with open arms as a boon to employment and regional economic growth. The same was true in West Virginia and other Appalachian states, where increased coal production was regarded as the remedy for the poverty afflicting the region. But these attitudes are now undergoing revolutionary change. Widespread public realization of the ravaging effects on the landscape of strip mining and other shortsighted industrial development is turning opinion around.

People, of course, are still interested in full employment, but those in the sparsely populated states are shifting their priorities. The commercial interests favoring exploitation of fuels and development of power plants and industry are now at least matched by people favoring slower and more balanced growth. A new value is emerging in our society. More and more people are becoming dissatisfied with material affluence alone and are opposed to the head-long rush toward industrialization. They see more damage than benefits to the community and their own lives from new industry, new developments and more people. This trend is apparent in the Pacific Northwest, New England, Appalachia, and the Southeast, and the suburban areas of every state.

The rancher in Montana, the fisherman in the Pacific Northwest, the mountaineer in West Virginia, the tenant farmer in South Carolina, the hiker in New England, and the cross country skier in Minnesota -- all these and like-mined citizens may have nothing more in common than a love of the earth the way it is. There may even be a strong streak of individual selfishness in this new movement, a feeling that we have made it and we don't want other people crowding in on us. One might sarcastically define an environmentalist as the fellow who bought his ski lodge last year. Whatever the motive, the movement to slow growth is a very real and increasingly powerful political force.

The opposition of local citizens to power plants, oil refineries, strip mining and like projects stems in large part because while most of the mess is left for them, the benefits go largely to people in cities far away. It is difficult to persuade the people of Colorado to ravage their countryside in order to supply fuel for Chicago and St. Louis and other population centers. True, we are one nation. And consumers in New York are being fuelb by natural gas from Louisiana. But in former days, the oil and gas producing states were eager to sell because they received large financial benefits and perceived no burden. Now the producing areas see their countryside and lifestyles endangered to satisfy wasteful consumption in faraway cities. The proposals for strip mining of coal, oil shale development, and construction of large power plants are not the subject of sharp disputes at the grassroots level. The energy companies share serious opposition in what was formerly docile territory. At the moment, the Chamber of Commerce argument -- we need the jobs -- may still be dominant, but public opinion is shifting rapidly to a new emphases on slower and saner growth.

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ENVIRONMENTAL EFFECTS: ASSESSMENT OF ENERGY DEVELOPMENT

Arnold J. Silverman*

INTRODUCTION--RESOURCES AND MAN

Resources are consumed or degraded at all steps of fuel cycles. The amount of consumption, or degree of degradation, are factors that must be weighed in comparing overall effects of different technologies.

What is a resource? Wagner writes that "features of environment, seen in terms of human ends and interpreted through a particular culture are, very broadly speaking, natural resources." This definition brings out that: first, resources are "things" used by man, and second, different cultures perceive resources differently: a resource to one human group may be worthless to another. Use of one resource generally affects other resources. Burning coal degrades the resource of clean breathable air. Also, the quantity and quality of a resource depends upon many environmental factors which operate to sustain it.

These environmental sustaining factors are also resources in the sense that man's continued exploitation of the resource depends on their maintenance. The failure of the Peruvian anchovy fishery illustrates this relationship. During 1972 the cold northward flowing coastal current along the Peruvian coast was warmed by the equatorial counter current, which in most years remains farther north. Salinity dropped and plankton abundance declined. This probably contributed to the 50% reduction to the anchovy catch observed in 1972. Since the anchovies are used to make fish meal for livestock and poultry, much of which is imported by the U.S., the anchovy crisis impinged on Iowa farmers. Thus, the Peruvian coastal current is a natural resource of Midwesterners. This reinforces the view that a perturbation in one part of a system may lead to major direct effects and numerous subtler elsewhere in the system. There is really only one resource: a biosphere of which man is a part.

As for the cultural perception of resources, cultures may alter with time, hence the value of a resource may vary. Thus the decision maker must consider time-dependence of cultural values as well as different perceptions of resources by co-existing cultures. The controversy over strip mining Black Mesa, a Navajo religious site, illustrates the different resource perception of two cultures.

The amount of consumption and degree of degradation are important in comparing effects of different technologies. Quantitative estimates of land and water consumed by steps in each fuel cycle are available. The amount of degradation of air, water and land, and the degree of denial of resources to alternative uses in the present and future, are hard to estimate. Part of any assessment effort should be devoted to improving the methodologies required to make these estimates.

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Resources are not uniformly distributed, and national level assessments neglecting regional distribution are subject to much error. For example, in northeastern Wyoming, an area with extensive coal deposits, there is a scarcity of water. At present approximately 151,000 acre-feet of surface water are consumed annually by irrigation while only 4,400 acre-feet go to industry. A new 1000 MWe power plant would consume 5,000 acre-feet/year by evaporative cooling -- about the same amount as presently used by all industry in the area. One way to support additional industry is to reduce agricultural water uses. Another would be to construct additional storage reservoirs on the Tongue and Powder Rivers, the only two rivers in the region whose waters may not yet be fully exploited. In any case, if projected industrial development is to be met, water will probably have to be imported into the region, along with local development.

ENERGY PLANNING AND ASSESSMENT

Rational energy-development policies, environmental control strategies, and energy-system research strategies require objective assessment of energy alternatives. In dealing with the external costs of the energy system, past effort has been largely confined to developing emission inventories and resource uses. However, environments are not simple, and just listing emissions and resource uses does not provide a reasonable description of environmental effects; the basic concern is with the effects of emissions on man and ecosystems. To estimate the biomedical and environmental effects of a fuel cycle, and each of its existing or proposed sub-systems, will be an enormous future task in Fort Union area coal research.

Most efforts to estimate the national environmental effects of the energy system, or a cost valuation of these effects, have proceeded with a "top down" approach - an aggregated overall estimate - approximating the total national costs directly, and then allocating these costs to the different portions of the energy system. Such an analysis is not based upon realistic models of the ways in which emissions and resource uses produce effects; thus, it is not representative enough of the diversity of local conditions. Nor, does a "top down" analysis provide reliable guidance for evaluating alternative energy-system development.

For this reason there is a need to approach the effects estimation problem with predominantly a "bottom up" strategy as follows:

1) Each portion of the energy system should be analyzed and associated with a set of "effects modules", i.e., effects common to different stages of various energy alternatives.

2) Then, because the effects which result depend upon local conditions, appropriate sets of standard regions should be developed.

3) Effects estimates can be made for these standard regions and

4) Estimates of local divergencies can be developed as a function of several variables.

5) Various national estimates can then be developed by summing regional estimates.

Any effort of this type faces fundamental methodological problems, and examples are described below:

(1) Effects ensue over different time intervals, intensities, and localities. How best to compare such effects? A specific example is found in sulfur dioxide emission from coal combustion. Fossil-fired power plants with short stacks, because of SO_2, noticeably affect local vegetation, animals (including people) and materials, but extended regional effects may be negligible. However, SO_2 emissions from tall stacks may produce reduced local effects while leading to serious long-term regional problems, acid rain among them. How does one effectively compare local short term effects with regional long term effects?

(2) Many of the effects which are of concern are poorly understood; e.g., the pathway of heavy metals through the ecosystem or the effects of the energy system upon atmospheric and oceanic circulation. Such gaps in understanding bedevils analysis. Uncertainty is also introduced by probabilistic effects such as large scale accidents. How does one compare effects describable with high precision with others which, because of incomplete understanding or their randomness, can only be described by a rather broad probability distribution?

These two examples underscore the need for new methods of analysis. Where one can, quantitative descriptions of effects must be made and when appropriate, also provide alternative costs estimates of these effects. The research community must strive to develop ways to integrate quantifiable effects with those effects which as yet are only semi-quantifiable. Without such an integration the result may worsen, not improve decisions.

ENVIRONMENTAL CONCERNS - SYSTEMS VIEWPOINT

Industrial facilities for a given energy source produce pollutant emissions from the activities associated with each component of the fuel cycle. The location, number, types, and sizes of these facilities will determine the quantity and character of the emissions. Pollutant analysis is required to identify these emissions by species, type, and amount with respect to each unit process of the fuel cycle. Such knowledge is critical for standard setting, monitoring and recognition of damage cause and effect relationships.

The pollutant emissions are transported (and transformed physically and chemically) through the air, surface and ground water, the soils, and biota. The rate at which these processes occur and the concentration and ultimate disposition in the media and plants and animals is required to understand the effects.

Ecological effects must be studied in a variety of situations, but particularly in relatively undisturbed regions where new energy activities pose and unknown threat to the ecological balance. These effects are important to understand and determine from a purely scientific point of view. An included emphasis of any study should be the interpretation of these effects with

respect to socio-economic and cultural variables (e.g., does the ecological effect pose a threat to agricultural, recreational, fisheries or other commerical interests? What is the nature of the threat and what economic impact might result?)

Physical effects are not necessarily caused by pollutants per se. Examples are landscape changes, stream diversion and changes in land use brought about by need for energy facilities and supporting services (new roads, railways, housing). These effects have aesthetic as well as economic implications.

A systems program for pollutant analysis must constitute measurement, monitoring and modeling activities for the following areas of environmental concerns:

1) Pollutant Analysis

2) Transport and Fate

3) Effects - Ecological; Physical; Social-Economic; Cultural.

4) Systems Evaluation

Systems evaluation refers to studies which cut across environmental areas of concern within a component of the energy cycle for a given source, as well as across components of the energy cycle.

The goals then of an environmental effects energy program are:

1) conduct environmental research in the areas of pollutant analysis, transport and fate, and effects as applied to energy cycles of alternative energy sources to provide the knowledge necessary to allow development of these sources in an environmentally acceptable manner

2) conduct the necessary systems evaluations and trade-off studies to provide results which will influence policy and decision makers in selecting the most appropriate energy development program based on achieving a harmonious balance among economic, ecological, physical, social and cultural factors.

In this context, the environmental aspects of a program include not only the natural environment in the restricted sense, but also include the social, cultural and economic aspects as well. Emphasis should be placed on providing and utilizing environmental data in conjuction with other pertinent data in a compatible manner so that trade-offs in evaluating alternatives may be made in an integrated fashion. The tendency in many environmental assessments has been to treat the environmental issue in an isolated or ad hoc manner often after the initial technical and economic planning studies have been conducted.

Setting energy policy requires evaluation of cost of various possible energy technologies. This includes knowing the effect of these technologies on health and the environment. The importance of "biological costs" is becoming recognized and much work

is being done on pieces of this problem. To estimate the biomedical and environmental effects of an energy system, and each of its existing or proposed sub-systems, in a systematic program, is a formidable demand facing all energy decision makers.

Most efforts to estimate national health and environmental effects of the energy system, of their costs, have proceeded from an overall estimate and then allocating these costs to different portions of the energy system. Such analysis have not been realistic because they have not taken into account the varying ways in which emissions and resource uses produce effects; moreover, they have not been representative enough of local diversities. Another approach, that upon which much of this paper is based, has been developed by the Biomedical and Environmental Assessment Group of Brookhaven National Laboratory (ERDA). These researchers estimate effects in specific circumstances, taking into account known variables, that will then be aggregated for national estimates. Each portion of the energy system is analyzed and associated with a set of "effects modules", i.e., effects common to different stages of various energy alternatives. Then, because the effects which result depend upon local conditions, appropriate sets of representative regions can be developed. Effects estimates can be made for these regions and summed to obtain national estimates.

DERIVATION AND ASSESSMENT OF EFFECTS

We are concerned with the changes in an ecosystem resulting from the introduction or operation of an energy system or part of an energy system. An ecosystem consists of the total array of plant and animal life, physical media (soil, water, air), the cycles of the system, and the energy which drives the system. "Effects" thus include changes in the physical environment such as the composition of the atmosphere, or in the mineral content of soils, as well as changes in the biotic system including man. The interactive nature of the ecosystem is such that a change in one part is the beginning of a chain of events which may lead to widespread change throughout the ecosytem.

The complexities of interactions in large ecosystems have made modeling difficult. Experience has shown that stress applied to one component of an ecosystem can result in important changes or effects in other components. The need to understand and describe these interactions in order to predict the impact of man's activities has prompted important ecological research. The results of much of this research are now available, or just becoming available. This is a key time to design an integrative system to make use of these research findings in assessment.

An approach taken by the Biomedical and Environmental Assessment Group at Brookhaven National Laboratory is to recognize that energy systems perturb several natural cycles. They are developing modules which contain a series of process vectors (Figure 1, 2, 3) making up the chain of events (or effects) resulting from an initial change. Each module is driven by an environmental stress imposed by a component of a fuel cycle.

Ideally, each of the individual vectors within a module will take the form of a quantitative function. The module then

becomes an operator which takes a set of initial conditions and a stress rate, such as tons per day of SO_2 emitted to the air, and converts these to a set of effects representing the difference between the initial conditions and the conditions after the introduction of the stress. The modules differ from natural cycles in that the latter describe the path taken by materials as they flow through an ecosystem, while the modules describe the chain of effects through an ecosystem. These modules are a new and workable means of predicting the total ecosystem impact of various stresses introduced by fuel cycles. They result in a system which is amenable to easy and rapid updating as new and better information on interactions becomes available, and provide the means of integrating narrowly defined research results into a broad assessment program.

There is a need for two kinds of data to operate the system: (1) damage functions associated with each of the vectors in the modules and (2) descriptions of initial conditions or base line studies. When extracting the needed data from relevant studies in the literature, one may find that the goals of these researchers, are not entirely consistent with environmental assessment purposes. It is frequently necessary, therefore, to re-define appropriate parameters and go to sources of raw data and to derive damage functions.

As for initial conditions, the effect on human health, for example, depends not only on the damage function, but on how many people are exposed. For an individual facility the set of initial conditions can be obtained by surveying the population surrounding the proposed site. However, for a broad national, or even a regional assessment program, individual site data are probably too expensive to obtain. The variety of potential site characteristics associated with any one fuel cycle component are sufficiently broad that the use of a single "typical site" for assessment is inappropriate. Some form of compromise is essential . Brookhaven is in the process of defining a set of regions within which the use of generalized site data may be appropriate. Within each region one or a small number of site characterizations will be developed. These will then supply the needed site data for the effects modules.

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BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK

Figure 1.

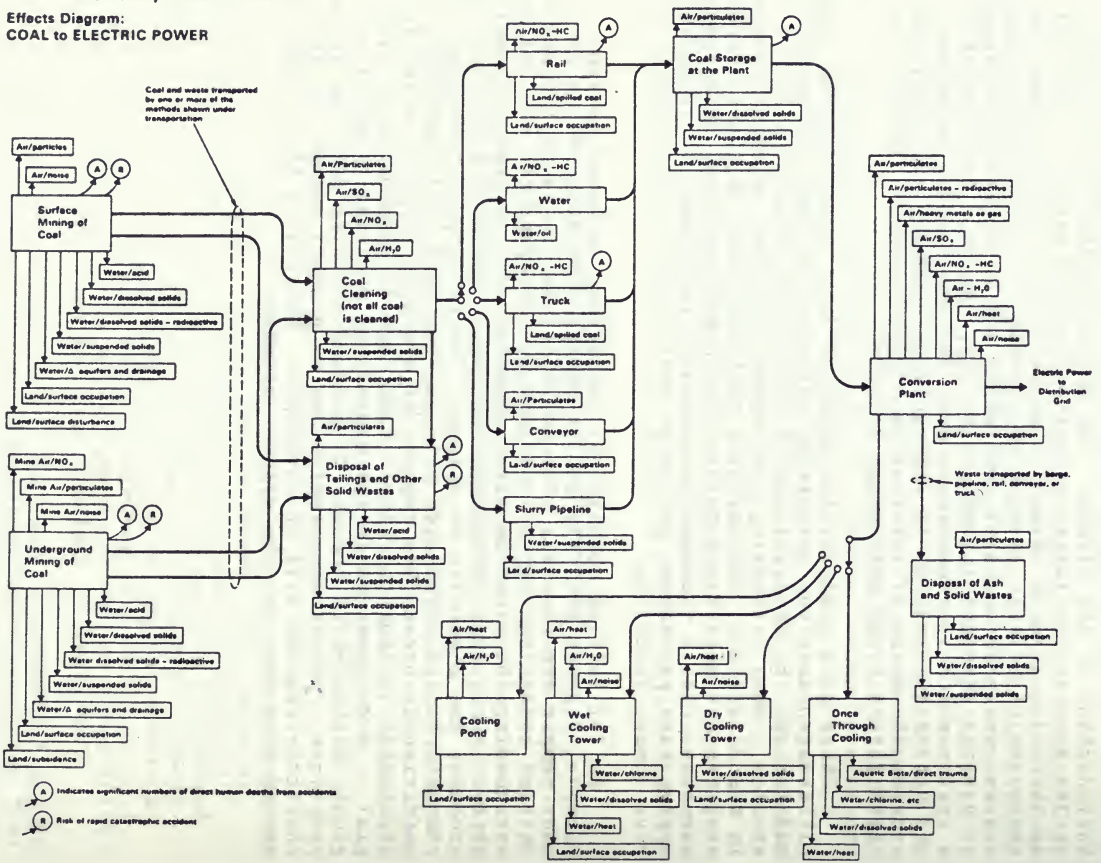

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Figure 2.

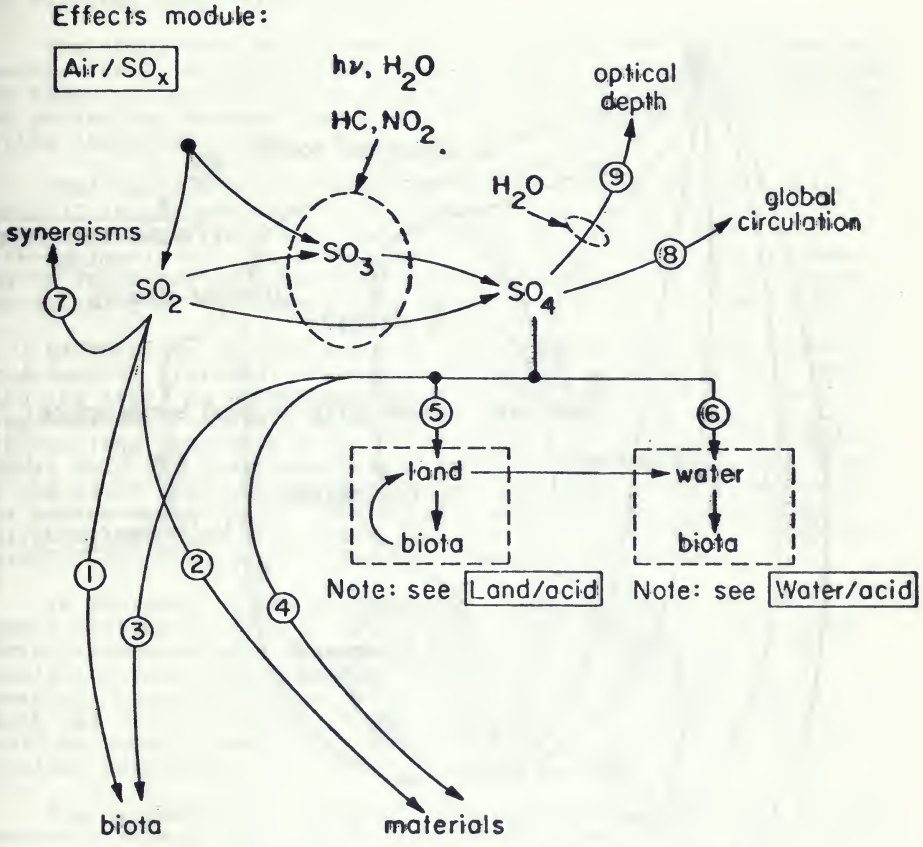

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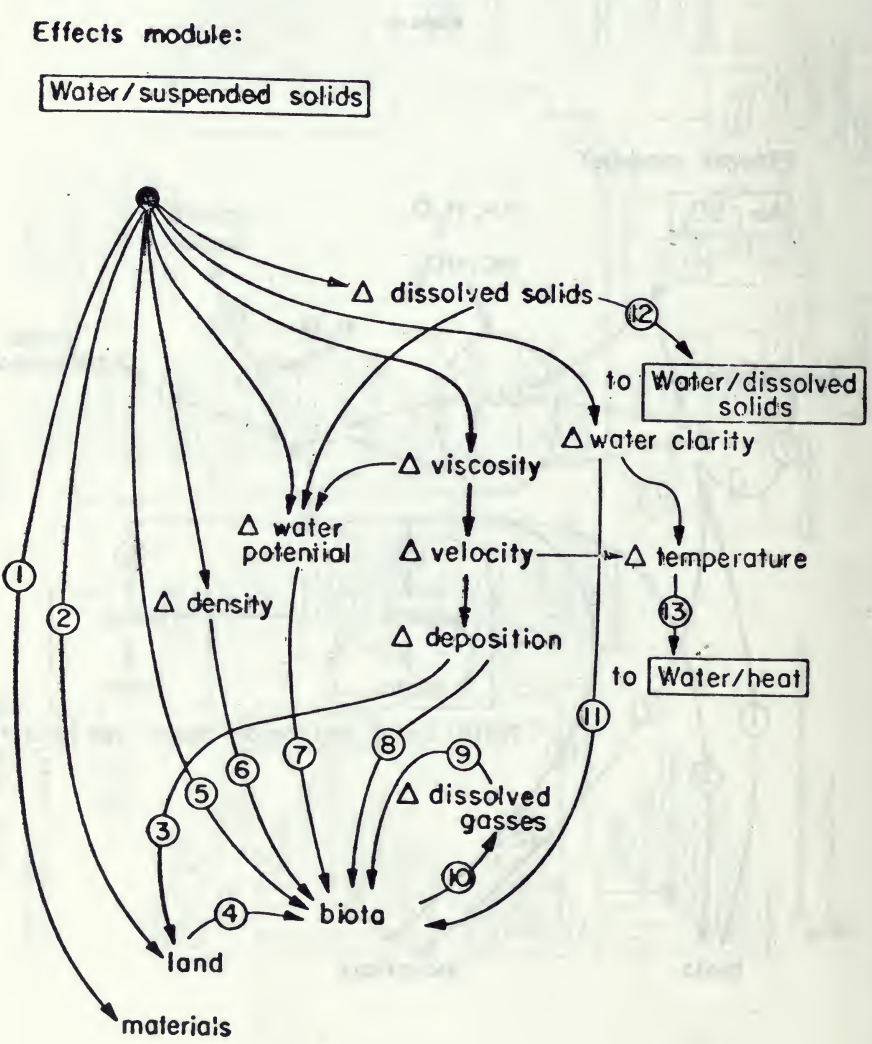
Figure 3.



SYNOPSIS OF THE DRAFT PROGRAMMATIC ENVIRONMENTAL STATEMENT FOR THE PROJECTED COAL DEVELOPMENT, CROW INDIAN RESERVATION

James F. Canan*

The Programmatic Statement as written was designed to be an educational document analyzing possible impacts of coal development on the Crow people and their resources. It describes two levels of coal development--a low or minimum level and a high or maximum level with alternatives running from no production, up through mining for export only to various mine mouth plants. The discussions of levels of mining, different coal uses, different location, and uses of the water resource are set up to give the tribal council a basis to discuss and decide what level of mining and/or plant development would best suit the economic, physical and cultural needs of the tribe.

The study does not recommend policy, nor does it propose any manner, level, or type of coal development. It does not represent the views of any individual or group. It is merely a fact finding and projecting document laying out forseen impacts for use by the tribal decision makers.

Some think this should be a decision making document with specific recommendations. It is designed to be an informative document giving broad analysis of impacts which may occur at various levels of coal development both on the Crow Reservation and in the ceded area north of the reservation. It should guide the thinking of the Crow people and open a forum for discussion.

Differences between the Crow Programmatic EIS and a regular programmatic statement include not only the geographic size but also the legal or ownership status of the land involved. Most programmatic statements cover large areas of public lands or of private land underlain with public owned coal. This programmatic covers only the Crow Reservation and the former reservation area to the north which has been ceded with private surface ownership and Indian owned coal. Public owned lands and coal come under state jurisdiction and regulations. Indian land is regulated by tribal resolutions and by federal laws and regulations.

In addition to the programmatic, specific enviromental impact statements must be written on each mining plan submitted. These statements must address all impacts in detail for site specific development. This statement was purposely broad to cover all aspects without being unwieldy and full of detailed technical data. The intent was to prepare a document which would be widely read and would be helpful to the general Indian populace making up the tribal council.

The programmatic statement covers the probable impact of two assumed levels of Crow Indian coal development on the Crow Indian Reservation and Ceded Area in Big Horn and Treasure counties of Montana. The Lower Level assumption projects the exportation of 20,000,000 tons of coal annually from three different mines. The Upper or Maximum Level projects the mining of 90,000,000 tons

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annually at the three mines plus three mining complexes utilizing a large portion of the coal in three conversion plants.

PROJECT IMPACTS

The projected impacts on the Crow tribal members and their resources are as follows:

A. Population in the study area will increase.

In 1970, Big Horn county had a population of 10,047. This population had been relatively static for a period of 40 years, 38.9% of the population was Indian. On the Crow Reservation proper, 56.1% of the population was Indian. Both Indians and non-Indians live mainly in the small towns and along the river valleys. Few Indians farm or ranch although these are the main occupations of their non-Indian neighbors. Hardin and Sheridan are expected to get the majority of the influx of people, especially the non-Indians, as school, residential, recreational, and service facilities are more readily available. Crow Agency, Lodge Grass, and the valley along the Little Big Horn River are expected to be preferred by the immigrating Indian workers and their families. At the high level, the number of new people settling on the reservation would be only 10% of the total increase but over 50% of the increased Indian population.

It is estimated the low level of production would only involve about a 10% increase in population as most of the workers could be drawn from the existing communities. The high level would be expected to increase Big Horn county population by 123%. Various mining levels between the two assumed levels would be proportionally different.

B. Income and employment levels will be increased.

At the two levels of production, anticipated royalty to the Crow Tribe would be at least $8,000,000 at the low level; and $36,000,000 at the high level. There are many alternatives for the use of this royalty by the tribe as:

1. Investment to be used for future income to tribal members
2. Develop Socio-Economic Programs
3. Venture capital for Indian enterprises
4. Distribution as per capita payments

The first three would ensure future income to the tribe and its members. The latter would substantially raise the annual short run income of individual Indians. Pressures from members on and off reservation is expected to result in a considerable portion being used in per capita payments. The statement uses two levels of distribution for each level of production. One shows 40% per capita payment and 60% for social programs and investments; the other is the converse 60% per capita and 40% retained. Direct employment of 450 workers is expected at the low level in the assumed three mines. At the high level, direct employment could exceed 6,500 workers. Service and associated activities are expected to utilize one additional worker for each worker directly employed by the

industry, or an additional 450 to 6,500 jobs depending on the production level.

The direct employment projected for coal development could result in aggregate employment income ranging from $5,400,000 to $78,000,000 annually. The Indian portion of employment income is estimated at $2,700,000 and $7,860,000 annually depending on the development level. The Indian salary income plus the royalty income could total $13,400,000 for low level production to $43,860,000 at the high level. The multiplier of 1.9 which was used to account for service industries, indicates a total local cash income ranging from $25,460,000 to $216,714,000 depending on the level of development.

C. The socio-political structure will be altered.

Indian income and jobs will cause significant changes but little stress in intercultural relations is expected at the low level of production as no major change in population is expected. At the high level of development, severe pressures on present intercultural relationships are likely to occur. The life styles of both Indian and non-Indian are expected to change from their rural society to a more urbanized environment.

A large influx of outsiders onto the reservation would force both the Indian and non-Indian residents into being minorities within their own environs. The political picture could change considerably with political dominance shifting. Present life style, culture, and the Crow language will probably be diluted to some extent. Only by maintaining political influence and the development of an effective planning process, coupled with effective controls, can the traditions and heritage for both Indian and non-Indian residents be preserved. Subdivision and zoning ordinances must be developed for each community, as well as all along the Little Big Horn River, to keep undesirable forms of residential and commercial development from occurring. Tribal, state, and county authorities must initiate coordinated joint comprehensive planning and land use controls.

D. Service Systems

Service facilities and the transportation system will require substantial expansion and addition. Public assistance requirements may decline during construction. It is possible a sharp continuing decline in Indian dependency on public assistance would occur due to substantial per capita payments as well as increased employment. Educational requirements will increase, making more teachers and classrooms necessary. These needs will be modest at the low level but at the high level, increases in elementary enrollment could be as high as 8,154 students. Secondary school enrollments are estimated at 900 new students. This requires 603 new classrooms and teachers, 29 of these are anticipated for new Indian enrollment.

Housing needs in the area are presently acute. Eight-hundred new Indian housing units are already needed. If these are developed, they will probably suffice for the low

level of development. At the high level, another 400 houses will be needed for Indian families and approximately 11,000 new housing units will be needed for all workers. Mobile homes will probably meet the initial need.

Health needs are expected to increase substantially only with the higher level of development. At this level, 43 more doctors would be a minimum needed. Proportional increases would be needed in nursing care personnel and facilities. A tendency for increasing acute social situations as alcoholism and emotional disturbances and the breakdown of primary social bonds of the family and traditional community is expected at the high level.

Political influence and community indentity and cohesiveness will be severely tested and could be lost without strong measures and organizational effectiveness.

Coal development income could result in better housing, more adequate nutrition, more pride in home and family and more determination to acquire more education and better jobs. Work habits will be formed and become a way of life. Added facilities for health and other services will provide other benefits. On the other hand royalty and per capita payments could cause social disorganization and individual problems resulting in increased alcoholism and other undesirable situations. A dependency on these payments could be very traumatic if and when mining ceases. The higher the level of development, the greater the transportation impacts will be, although the low level of mining will require almost as many access roads and will have a larger impact on the area on a per ton basis. The high level will require more highways and streets.

Communication facilities including mail service, telephone, television and telegraph will have to be extended and expanded. Major changes in services and utilities will be required at the high level of development.

E. Unsurveyed archeological and historical resources may be destroyed. This will occur unless great care is taken to examine areas where earth moving is to take place.

F. Air quality will be lowered and noise levels increased. At the high level, air quality will be degraded in the vicinity of the mines and industrial plants. Air pollution from gas or emissions should be minimal from the strip mines with proper controls. Stack exhausts will produce particulate matter, water vapor, carbon dioxide, sulfur dioxide and oxides of nitrogen, hydrocarbons and trace elements in varying amounts dependent on the control measures used. Noise levels will be increased from: increased traffic, blasting, loading equipment, mining equipment, coal crushers, trains, turbines and compressors as well as a hum from transformers and the constant roar of cooling towers.

G. Land surface may be altered both in use and productivity after reclamation. If total production on all areas were completed, 57,955 acres would be disturbed at some time. Original contours will be lowered and altered to some extent.

Reclamation efforts should return the land to its original use.

H. Vegetation will be destroyed by mining activities and plant sites. Livestock and game forage will be reduced during mining operations by loss of vegetation from all development areas.

I. Soil structure and parent material will be disrupted and altered. Even though the top soil is to be removed for reclamation, the underlying structure will be torn up and mixed by the mining operations. This will disrupt drainage and cause an entirely different subsurface structure which may be better or worse than the original structure.

J. Scenic views will be altered and aesthetic values changed. The land after mining may be returned to near the same contour but will be lower and the color of the introduced plants may not blend with the natural vegetation. Also any abrupt slopes or cliffs removed will not be returned to their original condition.

K. Wildlife habitat will be altered or destroyed. Trees and shrubs will be destroyed during mining and will take a long time to replace. Large wildlife animals and birds will relocate in other areas but small burrowing animals will be destroyed.

L. Recreational use will be intensified. The large influx of population will create a demand for outdoor recreation facilities which may not be available.

M. Water utilization and consumption will increase for mining and industrial uses. Mining for transport to other areas will not put much strain on water in the area as mine drainage can be used to wet roads and otherwise hold down dust. Wells can be drilled for domestic, culinary and sanitary uses in the plants, offices and other facilities. Processing plants as steam generating plants, gasification or liquefaction plants will have a tremendous consumption of water and require long pipe lines and a large water right.

N. Valuable energy resources will be made available for utilization. Coal will be mined to be used in steam generating plants on or off site as well as for gasification or liquefaction of the energy source for transport by rail, pipeline, or on transmission lines to nearby states as well as across the nation.

PRODUCTION-NOW AND PLANNED

One of the mines discussed in the low level development has started production on the Ceded Area. Westmoreland Resources is presently strip mining approximately 4,000,000 tons of coal per year for exportation, with plans to increase production substantially in the near future, with a goal of 10,000,000 tons by 1984.

Shell Oil Company has presented mining plans. An Environmental Impact Statement is being written with U.S.G.S. as

the lead agency. Shell plans call for opening a mine in the Youngs Creek Area in mid 1977 and strip mining 2,000,000 tons the first year and increasing production at the rate of 2,000,000 ton per year until reaching 8,000,000 tons per year from this mine in 1980. All of this coal is for export, mostly to Texas and Louisiana. Projections from just two mines indicate the low level assumptions could soon be met and the high level assumptions are entirely possible by as early as 1995 or 2000. The level which will actually be reached appears to depend entirely upon the desires to the Crow tribal people toward the development of this resource.

PUBLIC COMMENTS

Responses to this Draft Environmental Impact Statement were received at the Public Hearing on March 26, 1975 and in writing from federal and state agencies, private groups and individuals. The comment approach as a public forum is emphasized by the following typical criticisms:

A. Many comments were received calling the statement too narrow, not enough detail and not specific. This is true but purposely so. It was written to give general guidelines and information to tribal decision makers for all types of impacts governing many possible coal development alternatives. When mining plans are developed by lease holding companies they are required to present specific, detailed, environmental impact analyses. A lead agency of some governmental entity, probably U. S. Geological Survey, will be appointed to write a complete Environmental Impact Statement covering the entire area to be impacted by that development, if the mining plan is approved. This statement must be very detailed for that specific mine or conversion plant. It would be too speculative for this statment to try to give specific details for all possible future mining proposals.

B. The programmatic statement does not comply with State of Montana policy of export only: There is conflict of opinion as to whether state laws or policies apply to the Crow Reservation. The programmatic environmental statement does not recommend any coal conversion development but feels it should show impacts of different plants being developed in case the tribe wants them. Furthermore state policy could also change and the Crow people should have this development possibility brought to their attention.

C. The probable impacts on Hardin and Sheridan were not considered properly. In depth studies of these two communities, which will probably experience large portions of the impacts, was not done as this was designed as a study of the impacts of coal production on the Crow Reservation and its people and resources. It shows projected population impacts and gives some socio-economic projections. Detailed analysis would be very time consuming and would add greatly to the size of the document. Specific mining plans will call for detailed Environmental Impact Statements going into the required to cover these communities. This statement alerts them of possible impacts.

D. The statement did not give a recommended level of coal development. This is not a decision document. Data were given to apprise tribe of possibilities but they are to decide on levels without recommendations or pressure.

E. The statement did not discuss economics of a negotiated lease. The royalty rate assumed in the programmatic was based on a rate approximating the 1975 Westmoreland negotiated rate which is on a sliding scale. Any new rate should be set by the tribe and individual companies using coal prices, cost of living index, reclamation costs and any number of other set and variable factors to arrive at a base for what will presumably be a sliding scale rate structure.

CLOSING COMMENTS

All comments received both orally and written are carefully studied and answered. Even after the final draft of the environmental statement is released, there will be many other factors which must be considered by the Crow Tribal decision makers. Some of the factors which may affect coal development decisions include:

(1) Pending national strip mining bill.
(2) State taxation of Indian coal.
(3) Settlement of Indian water rights questions.
(4) Decision as to status of state authority on Indian lands.

* * *

AVAILABILITY OF WATER FOR ENERGY USES

Ronald W. Krueger*

In 1974, for the first time in 22 years, energy use in the United States fell. Measured in British thermal units, energy use fell by 2.2 percent over 1973. There were a number of reasons for the decrease: The Arab oil embargo, higher prices, the economic slow down, successful conservation efforts, and a relatively mild winter. Everyone knew that we could reduce our consumption of energy. After all, when we manufacture cars that get under 10 miles to a gallon of gasoline, when we see buildings that are lighted 24 hours a day, when we swelter in homes heated in the high 70's, and when huge neon signs blaze a trail into and through a city, it is not difficult to pinpoint areas where conservation measures can be practiced. But with a mind-boggling projection of an increase of 100 million people in the population of the United States within the next generation, it is also not hard to see that demands for energy will increase. In fact, before the end of this decade there may be severe shortages of electric power.

In the short term--that is, during the next 3 to 5 years--it seems to me the only energy options open to us are additional conservation and getting into operation the powerplants that are under construction. In the long term--that is, after the year 2000--we must have more sophisticated energy options, options that for the most part are not dependent upon nonrenewable resources. Options open to us in the long term might be fusion power, geothermal power, harnessing of the wind, harnessing of the waves, harnessing of the tides, conversion of waste materials, and perhaps other options not yet thought of.

But what option do we have for the intermediate future? Much as some of us may not want to think of it, I think the answer is obvious: Coal. In the Northern Great Plains there are something like a trillion and a half tons of coal. Of this amount 230 billion tons are economically minable under current technology. If we are to reduce our dependence upon foreign oil--which can be shut off with a turn of the spigot, as we so well know--some of this coal must be mined. But adequate planning must be done and strict regulatory legislation enacted before Northern Great Plains coal is mined to any appreciable extent. The U.S. coal reserves contained in the Northern Great Plains states must be mined in an orderly manner and with extreme care to protect our quality of life.

Water, of course, is essential to this development. Consideration must be given in planning, developing, operating, and managing all sources of water and all uses of water so that we are providing for the needs of today and tomorrow. The Bureau of Reclamation stands ready to work with the states in this consideration.

Exclusive priority cannot be given to any one function

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Bureau of Reclamation, Billings, Montana

under the multiple-use concept and emphasis can and should be redirected from time to time. Over the years, storage facilities have been built by the Bureau of Reclamation which have provided immediate benefits such as flood control and power production. The reservoirs were created years before lands of the projected service areas were to receive water for irrigation. Consequently, the Bureau feels that water earmarked for eventual agricultural use can be made available for other beneficial uses such as energy on an interim basis. We have observed and can reasonably project that in most areas the water resources reserved for eventual agricultural uses have not and will not be fully developed for many years to come. Thus, there is adequate water for projected coal development. Under a concentrated program of development that will include proper planning and research, there is no valid reason why water used for energy production for the next 30 to 40 years or so should be lost to the agricultural community in the long run.

The Bureau's efforts in developing Basin-wide total water management programs will hopefully result in a more efficient use of available water supplies. Long-term growing needs for agricultural production will eventually be served by any structures built, to initially meet emergency needs for energy purposes. They will also serve other primary functions such as flood control, municipal water, recreation, quality control and fish and wildlife enhancement. With efficient and proper planning, the development of water for energy could advance the availability of water for other uses.

A landmark action took place just 2 months ago, when a memorandum of understanding was entered into between the Secretary of the Interior and the Secretary of the Army. The document is a 2-year agreement intended to provide for the marketing of Missouri River water by the Bureau for energy development in the Missouri River Basin. Each state in which the water would be used would be offered first choice to contract for the water. This arrangement would allow the states to market directly to the industrial firms, if they so elect. An outgrowth of the Interior-Army agreement will be the development of a long-range marketing program for municipal and industrial water.

And so a commingling of short- and long-term objectives with the short- and long-term needs of the Nation requires a willingness to accept the middle ground between the extremes of exploitation and a total preservation of resources. Faced with this challenge, it will require a program of comprehensive planning and research culminated by a program of orderly implementation.

We have the ability and the technology to meet the challenge and enough foresight to forestall a crisis situation. Using its considerable scientific and technological sources, the Bureau of Reclamation will continue to meet this challenge as it continues to develop, maintain, and protect water and related resources for this and future generations.

* * *

AVAILABILITY OF WATER FOR FUTURE USES

Phil Q. Gibbs*

For the past 8 years the Bureau of Reclamation has believed that further development of our water resources would be desirable for agriculture and essential for coal conversion. Over this period we have explored potentials for serving water to the major coal deposits in the Fort Union-Powder Basin Coal Region.

During our investigations, water availability has been determined for most of the sizeable streams in the region. Generally speaking, the amount of usable additional water that could be derived from local storage systems or tributary streams ranges from about 100,000 acre-feet annually down to around 10,000. So, we might say that almost any of the principal streams could supply water to one or more coal conversion facilities. In each case, the required storage impoundments would result in a loss of habitat for either big game or game birds; storage would usually be too costly for irrigation and would not always be cheaper for industry than an aqueduct system from more distant places. Without more study, it appears that storage development and water supplies on most of the streams within the region would not be the best solution.

Looking further, we have explored ways and means of obtaining water from the major streams where large-scale diversions and bulk movement of water might be expected to have economy. There are only six sources within the region where amounts greater than 250,000 acre-feet annually can be accommodated. The six locations are:

1. Bighorn River at or below Bighorn Lake (Yellowtail). This route could serve Wyoming only, or also serve the western coal deposits in Montana and on Crow Reservation as well as the Gillette, Wyoming, area.

2. Yellowstone River near Miles City, Montana. Such a route could serve Wyoming only, or could include service to the eastern deposits in Montana.

3. Fort Peck Reservoir. Service would probably be limited to Montana areas north of the Yellowstone River.

4. Lake Sakakawea (Garrison). This source could serve the entire coal area within North Dakota and would probably be limited to that state.

5. Oahe Reservoir. A diversion from Oahe could serve the Gillette area of Wyoming. And, while South Dakota has no important coal reserves, the western half of South Dakota needs water for municipal, light industrial, rural domestic, and livestock uses and could benefit from an aqueduct across the state.

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6. Green River, tributary to Colorado River, near Rock Springs. This would be Wyoming water for use in Wyoming by transbasin diversion. It would come along I-80 and into the Platte River where it would flow to the vicinity of Douglas for rediversion to Gillette.

Looking in detail at the Wind-Bighorn River and storage system, we see the largest tributary of the Yellowstone River. The Wind-Bighorn still produces 2.5 million acre-feet in an average year even after serving about 515,650 acres of irrigated lands. Of these, 436,350 are in Wyoming and 79,300 are in Montana.

If and whether the potential 44,000-acre Hardin Bench Unit below Yellowtail Dam, the potential 19,000-acre Polecat Bench Unit below Buffalo Bill, and the 59,000 acres of irrigation projected upstream from Boysen Reservoir ever get built, it would still be reasonable to supply a large quantity of water to industry from the Bighorn and its storage impoundments.

Actually, potential irrigation is difficult to project. The State of Montana currently advocates that its waters be preserved for future irrigation and that industry be denied water for coal conversion. This may be wishful thinking, however, because irrigation units are very hard to justify. From our own experience we can state that the best pump unit along the Yellowstone is not presently feasible using Federal criteria for justification. Private development has no such guidelines and there will probably be some limited developments by individuals or small groups using private financing.

We have concluded that there will be some future irrigation but it will be much smaller than many suppose. Not one unit that we have investigated over the past many years can presently demonstrate economic feasibility and our most recent project is already about 10 years old. Thus it looks to us that there is not much possibility for competition between water for land and water for coal. Anyway, there is enough water for both. Any conflict over water is between those proponents of development and those who prefer nondevelopment.

The Bureau of Reclamation has optioned 708,000 acre-feet of water from the Wind-Bighorn system for the future use of coal conversion. Some of the contracts are nearly 8 years old by now, but we still have no idea whether the water will be used or where it will be delivered.

Only water which we determined would be surplus to existing and projected future needs for irrigation was optioned. We also attempted to safeguard eventual Indian water needs in those determinations. As of now, we are committed to 85,000 acre-feet annually from Boysen Reservoir and 623,000 from Yellowtail. The Boysen water can be taken from the reservoir or passed down to Yellowtail. Then it can be taken out of Yellowtail, below Yellowtail at either Hardin or Miles City or even down at Oahe Reservoir in South Dakota.

One thing we know is that in the Bighorn River 80 percent of any water surplus to 1950 water right entitlements is allocated to Wyoming. Another thing we know is that the recent

suggestions and support for instream flows may or may not be a problem; whether it is could depend largely on where the water may be diverted, but there may also be some legal considerations.

The Yellowstone River produces 8.8 million acre-feet of water now in an average year which is beyond the requirements of present water users and left over after they have satisfied their needs. This is more water than the Lower Colorado River has, and that river supplies a large part of the water needs of Arizona, California and Nevada. My point is that 8.8 million acre-feet in the Yellowstone is adequate to serve all of Montana's real needs and still have water left over. Storage may be required to regulate the water supply and to insure against occasional dry periods, but the overall amount is far beyond all reasonable needs.

Of the waters in the Yellowstone River, Wyoming has a right to 2.4 million acre-feet. They may not care where they get their share from, but they are certainly entitled to get it - after all, Wyoming supplies more than 7 million acre-feet to the Missouri River System, and Wyoming contributes more to the Yellowstone than Montana does.

Fort Peck doesn't require much explanation. It is a huge reservoir of 18,900,000 acre-feet with an average outflow of 6,838,000 acre-feet. Most of the coal near Fort Peck is in McCone County and there is obviously no shortage of available water to support whatever developments are proposed. So far there are about 800,000 acre-feet of applications for Fort Peck water, but only the proposal by Burlington Northern Railroad for their Circle West Project has received much attention.

Lake Sakakawea behind Garrison Dam is another huge impoundment, even larger than Fort Peck. It contains 24,200,000 acre-feet and has an inflow of 16,952,000 acre-feet per year. It appears to be the logical water source for most potential developments in North Dakota and most of the major coal deposits lie south and southwest of the reservoir.

The terrain is not complicated so that aqueducts could take almost any practical route from the lake to the coal. Probably the biggest problem from an engineering standpoint is the absence of good pumping plant sites. There are only a few and one appears to be much better than the others. It is not far below where the Little Missouri enters the lake.

North Dakota could actually count entirely on Lake Sakakawea to provide the energy development they want without even getting involved with any other state.

South Dakota has little coal but it has a large water supply in Oahe Reservoir. This reservoir holds 23,500,000 acre-feet which is larger than Fort Peck but smaller than Garrison. Its inflow, though, is larger and averages 18,525,000 acre-feet annually.

The western half of South Dakota is generally dry and short of good water. Most of the streams outside the Black Hills are not good producers and generally have poor chemical quality.

Water for the Gillette, Wyoming, area coalfields could be served by aqueduct from Oahe Reservoir. The unit cost of delivered water will be higher for this route, but is has several advantages to offset the economic disadvantage. For instance, it would not be confronted with the Yellowstone Compact, it would prevent conflicts between instream flow advocates and diversions, would allow continued generation at Garrison, would eliminate the need for new storage, would provide industry with water of better quality than is available from Power River, Bighorn River or ground water, and would preclude the need for transmountain diversion schemes. Also of large benefit, an area near an aqueduct in South Dakota could obtain municipal, rural domestic, and livestock water of good quality. The state might have to choose between a route north or south of the Black Hills based on which would serve the greatest number of people.

Wyoming has a share of Colorado River water for which they have no local need. It is estimated that up to 300,000 acre-fleet is surplus to Wyoming needs within the Colorado Basin and Wyoming has some desire to utilize its entitlements. This might require that water be exported to the eastern Wyoming coal reserves..

A route along I-80 to the Platte River and a rediversion from the Platte somewhere in the Casper-Douglas vicinity would then proceed northward toward Gillette.

Such a route would be able to deliver water at a rate cheaper than the Oahe route and not much higher than the Miles City or Hardin routes from the Yellowstone Basin.

From a national viewpoint a diversion of excellent quality water from the Green River might be frowned upon because of salinity problems already evident in the lower Colorado, but from a state viewpoint there is no reason to expect Wyoming to sacrifice its legitimate water allotment to solve a basinwide problem.

The Upper Missouri Basin includes everything above Sioux City, which is the demarcation line between the dry upper basin and the wetter downstream basin. It also is the head of navigation and the foot of main stem storage.

Some have asked a question such as why take water away from hydropower to use for cooling water for steam generation. The answer is that 1 acre-foot diverted will result in a hydropower loss of 430 kilowatt-hours, but the generation for which it provides cooling will produce at least 350,000 kilowatt-hours, or more than 800 times as much.

Water depleted in the upper basin will also shorten the navigation season. A measure of the effect is that 50,000 acre-feet of depletion will shorten the usual 8-month navigation season by 1 day.

Water costs have been computed on the basis of 8 percent interest, 8 mills per kilowatt-hour for pumping energy, and 40-year repayment of capital costs. All costs given today will be on those premises. The amounts of water diverted vary

considerably and this would have an effect, but the amounts used in the studies range generally from 300,000 to 600,000 acre-feet of annual diversion.

Water from Hardin to Gillette will cost about $200 per acre-foot. From the reservoir, the costs will be about $20 higher. If water is delivered south of Gillette, the costs will be higher by about $50 because of the longer distance.

The route of the Miles City to Gillette aqueduct happens to be the cheapest source of water for Gillette because it is shorter. The elevation difference is greater than from Hardin but the route is still cheaper. In addition to the vertical difference through which the water must be lifted, there is also a friction head loss which can vary from 5 to 12 feet per 1,000 feet depending on the economics of pipe sizing and pumping energy costs. This factor is a major consideration in all engineering studies. Cost of water for this route was about $200 per acre-foot.

North Dakota can get by with a system going south and southwest of Lake Sakakawea. A large pumping site on the south bank could serve lines branching to most of the logical sites for coal conversion plants.

Costs for the gasification and generation sites used in the Northern Great Plains Resource Program will average about $80 per acre-foot.

South Dakota would not share in coal development, but they could benefit from any aqueduct going from Oahe Reservoir to Gillette. The route would have to skirt the Black Hills either to the north or south, and the state would have to be in on any decision as to choice of routes. It might happen that with staged development both a north and south route could be attainable. Costs of either look about the same and the unit price is about $294 per acre-foot for 300,000 acre-feet.

We have examined a route for transporting Green River water to the Platte River and rediversion toward Gillette. The cost of this water would run about $235 per acre-foot for 300,000 acre-feet, which is the largest size that can be considered from this source. By approaching the Gillette coal reserves from the south, it shortens the distance involved over a route coming from Montana.

Fort Peck and its nearby service area north of the Yellowstone could be delivered water at a cost of about $50 per acre-foot.

If you have wondered how projected water uses in the upper Missouri compare with water availability, the attached Figure 1 will show you the history of projections.

The bottom curve on Figure 1 has been broken down into the projected individual uses shown on Figure 2. Note two things: (1) Coal is a small part of the probable future depletion and (2) the projection does not reach up to the amount of water available in the upper basin region.

You may have noted that this paper discussed only surface

Figure 1

COMPARISON OF PROJECTED STREAMFLOW DEPLETIONS
ABOVE 1949 LEVEL OF DEVELOPMENT

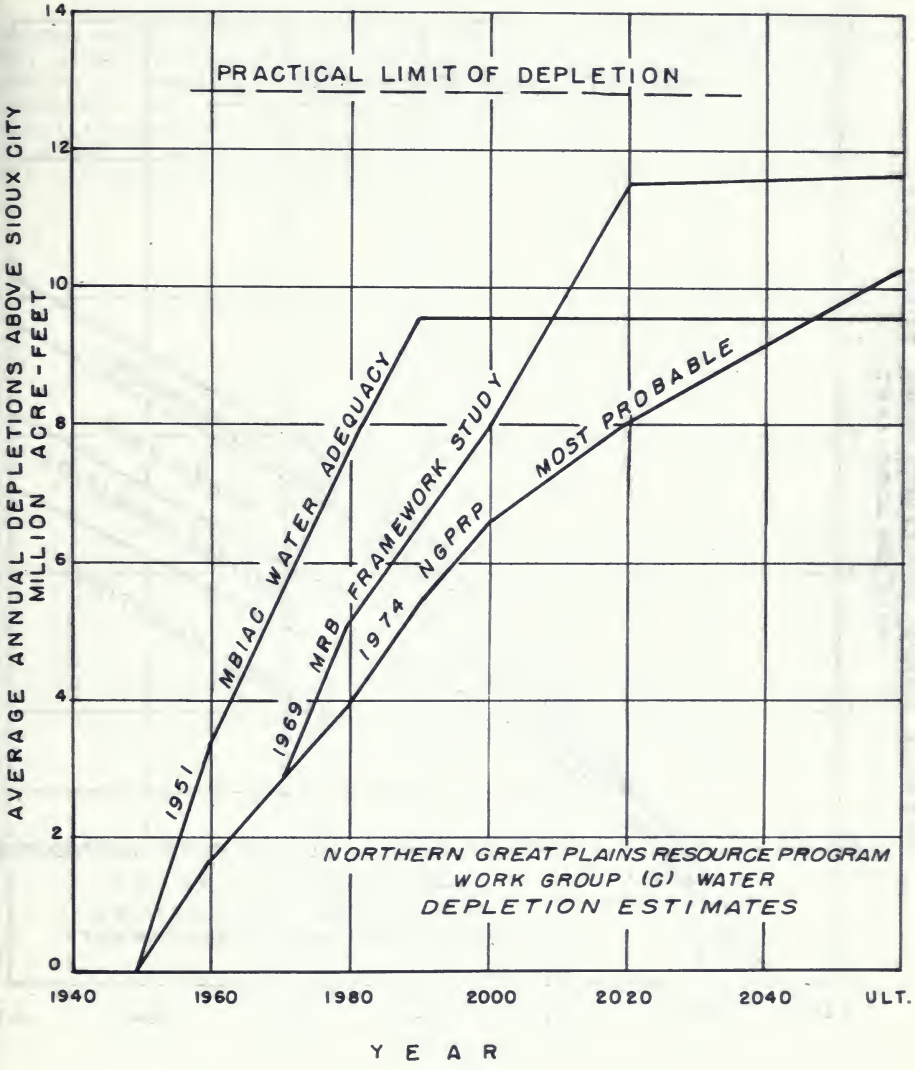
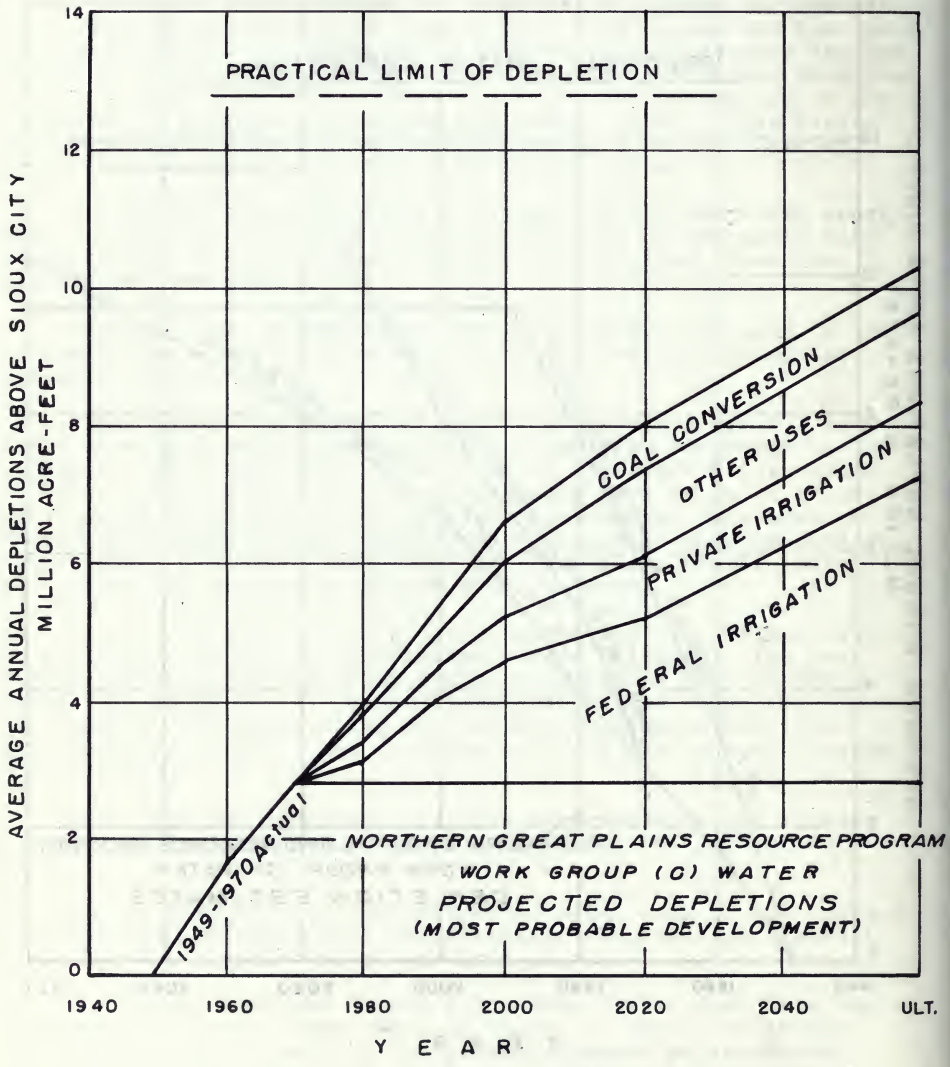


Figure 2

PROJECTED CAUSE OF DEPLETIONS
ABOVE 1970 LEVEL OF DEVELOPMENT



water. Ground water from the deep aquifers could turn out to be the cheapest source of water for coal conversion; but so little is known about chances for and cost of recovering deep ground water that energy companies have been reluctant for the most part to explore the potential. Publications which are available show probable poor quality, questionable yields, and difficult solutions to the questions of recharge and drawdown. If everything worked out well for ground water, it could probably be obtained for a cost of about $60 per acre-foot.

It looks now that there is enough coal, enough need, and enough water to help the Nation solve some of its energy problems. We, along with others, are sort of waiting in the wings until action is demanded. We now have an agreement with the Corps of Engineers that we will market the industrial water from their facilities and we are trying to work with the individual states on a way to market through them if they want to promote water use and help guide development.

* * *

SO YOU THINK YOU WANT TO MINE ON INDIAN LANDS

Pemberton Hutchinson*

INTRODUCTION

"So you think you want to surface mine Indian coal in Montana!" This statement expresses in its innuendo the many frustrations, obstacles and challenges Westmoreland Resources has encountered as it prepared to open a strip mine. Contrary to what you might expect, now that we are in operation, frustrations, obstacles and challenges remain and will no doubt be with us for many years to come.

In keeping with the broad theme "Diversity and Evolution of Coal-Energy Development in the Fort Union Field", the following represents a synopsis of Westmoreland Resources' experiences in the development and operation of a surface mine.

Westmoreland Resources was formed as a Montana general partnership in September 1970, at which time it acquired prospecting permits on approximately 30,000 acres of coal lands owned by the Crow Tribe of Indians and located within the 'ceded lands' which fall outside the reservation. The partners presently comprising ownership of Westmoreland Resources are: Westmoreland Coal Company, Penn Virginia Corporation, Kewanee Oil Company, and Morrison-Knudsen Co., Inc.

FIRST MAJOR PROGRAM

Our first major program was to conduct an exploration program designed to define the quantity and quality of the coal reserves. After completion of the basic exploration program, we set about bringing together all of the basic elements that constitute an operating mine.

1. Conversion of prospecting permits into leases.
2. Obtain long term sales contracts sufficient to support development of the mine.
3. Enter into an agreement for the mining of coal with a contractor.
4. Contract for the construction of a railway spur from the main line of the Burlington Northern to our Sarpy Creek coal reserves.
5. Prepare applications to the State of Montana, the United States Geologic Survey and the Superintendent of the Crow Indian Reservation for consents to mine.
6. Study of sufficient engineering, coal reserves, and other factors to determine location of rail spur, rail loop, plant and initial mine pit.
7. Acquire surface lands, or access thereto, which would permit mine development and operations.

*Pemberton Hutchinson, President
Westmoreland Resources, Billings, Montana 59103

Our major problems really began in early 1972, when we ran head on into the problem created by separate surface and coal ownership. While the Crow Tribe owned the coal, it did not own the surface lands, which had in earlier years been homesteaded by non-Indians. Unwillingness of non-Indian owners to sell or lease surface lands forced us at the outset to relocate the mine-site originally planned and forced abandonment of the originally planned and engineered rail spur route.

From this point forward, the problems grew geometrically more frequent and certainly more difficult. They are summarized below.

SUMMARY OF PROBLEMS

Construction of Rail Spur

The Burlington Northern had to acquire 38 miles of right-of-way from a number of landowners along the planned spur line. In the end, the Burlington Northern entered into five condemnation suits and won all of them in federal district court. In two cases the landowners appealed the district court decision on the basis that the spur line was actually a "main line" and therefore required I.C.C. approval. If the Court of Appeals ruled the spur line was actually a main line, then ICC approval would have constituted an act significantly affecting the environment, and therefore the National Environmental Policy Act would have required completion of an environmental impact statement prior to, and as a basis for, approval. In view of delays frequently inherent to the federal bureaucracy, we believed an adverse ruling by the Court of Appeals would cause sufficient delay so as to bring our mining plans to a stop. So, again, the spur line was rerouted to effect a compromise with the landowners.

Meanwhile, one of the counties through which the spur would pass filed for and obtained an injunction. Among the County's motivations was a concern for safety of crossings. Finally this issue was settled at great cost, particularly involving road crossing signals unprecendented in Montana.

And if all that wasn't enough, the line had to corss two state owned sections of land, which required state approval. The Burlington Northern was required to file an environmental impact statement with the State before approval could be granted.

I date say that as a result of the foregoing, this spur line has more environmental protections, culverts, safety signals and cattle underpasses built into it per mile than any rail line in history.

Montana Environmental Policy Act.

After we had filed our application for a mining contract under Montana's 1971 Law, the Commissioner of the Department of State Lands notified us in September, 1972 that a decision had been made by the Montana Environmental Quality Council that this Act applied to state approval of mining and that, therefore, we were to prepare an environmental impact statement for the state's use. Clearly we faced another material possibility of delay which could have brought our mining plans to a halt. But, in

another sense, it was a blessing in disguise because it forced us into a position of readiness for what was to happen under the National Environmental Policy Act.

National Environmental Policy Act

Through November, 1972 the Bureau of Indian Affairs and Department of Interior had taken the position that NEPA did not apply to Indian lands, and their position was based on a district court decision. On November 28, 1972 the district court's decision was overturned on appeal. Three months after that reversal, the BIA and Department of Interior decided not to appeal the appelate Court decision and directed full compliance with NEPA on Indian lands. Therefore, an environmental impact statement was required before our mining plans could be approved. This turn of events suggested the possibility of delays which would have had very expensive results given the contractual commitments and expenditures incurred by this time.

Montana Legislature

During its 1973 session, the Legislature actively considered a moratorium on further mining approvals. As I recollect, the moratorium lost by only one vote in the House.

But the legislature did enact significant legislation (i.e. The Montana Strip Mining and Reclamation Act, The Coal Conservation Act, and The Utility Siting Act). In addition it raised the severance tax from 8¢ per ton on coal of our quality to 34¢ per ton.

For the purposes of this history, the most difficult problem was posed by the extensive application requirements of The Montana Strip Mining and Reclamation Act. It rendered void all application preparation and submissions pursuant to the 1971 Act, and so we had to start all over again. The difficulties were compounded because many of the detailed requirements were to be formulated in regulations which could not be completed until the fall of 1973. To retain our sales contracts, we had to obtain federal and state approvals by January 1, 1974. So we had no choice but to conduct all the preparatory work in anticipation of what the regulations might contain.

Hearings

In early November, 1973 the BIA and State of Montana jointly conducted a hearing on the environmental impact statement. One week later the BIA conducted another hearing on the EIS for members of the Crow Tribe only.

In early 1974 the State held a hearing on our application for a water permit, which would have allowed us to use water from a 7,500 foot well, principally to sprinkle on the roads to reduce dust levels. The hearing had been requested by a few non-Indian landowners who were seeking ways to stop us. The state subsequently granted the permit.

Environmental Lawsuits

In June of 1973, the Sierra Club and others entered a suit

against the federal government designed to restrain all further coal mining in the northern plains. The plaintiffs essentially claimed that an impact statement for the Northern Plains Region was required under NEPA before specific coal projects are approved. At the district level the plaintiffs suffered a resounding defeat. Because this suit could have restrained approval of our mining plan we were forced to intervene. The case was appealed and has been argued before the Circuit Court. No decision has yet been rendered.

In February, 1973 a few non-Indian landowners in our lease area and Friends of the Earth entered suit. There were claims contesting the Crow Tribe's ownership of the coal, the validity of our 1972 leases, and the adequacy of the environmental impact statement. The district court ruled fully in favor of the defendants (Westmoreland Resources, Crow Tribe, Department of Interior). Subsequently the dissenting landowners expressed willingness to sell their lands or trade them for other lands we were to acquire. Fortunately Westmoreland Resources and those landowners were able to work out trades and sales to the mutual satisfaction of each. Thereafter, all of the dissenting landowners except one withdrew from this suit. The remaining landowner and Friends of the Earth appealed the district court's decision, and a decision is pending in the Court of Appeals.

The Crow Tribe of Indians

In late October and early November, 1973, we offered to renegotiate royalty terms with The Crow Tribe. We made this voluntary offer because we believed the fixed royalty of 17 1/2¢ per ton was not fair. If this mining project was to succeed to the benefit of lessor and lessee we would need the Tribe's support over many years, and so we believed our voluntary offer was in the mutual interests of lessor and lessee.

These negotiations were intense and the Tribe was fully advised by extremely competent experts. This team of Crows and experts were the most formidable negotiating team I have ever encountered. They clearly bargained the best compensation received by any coal owner of this quality of coal. But after reaching full agreement, the Tribe wanted more, in addition to a few changes, so we consented to a second round of negotiations. Again, in June of 1974, we reached full agreement on revised lease terms. The revisions went before the Tribal Council (consisting of the entire voting membership of the Tribe) for approval later in the month and was resoundingly defeated. There were a myriad of reasons, of which the most significant may be the non-Indian huckster's who volunteered to the Tribe that they would negotiate still a better deal for the Tribe for rather innocent sounding fees. In one case, the fees would have amounted to more than $20 million. But the real problems causing the impasse really seemed to related to the tribal political machinery and some fear of making important positive decision, which one can understand retrospectively examining Indian history. Given the vote of the Tribal Council, the attorneys for the Tribe had to carry the ball and they had little choice but to contest the validity of the leases. They filed a petition before the Secretary of the Interior seeking to have the leases declared null and void. After the filing of responses and counter-responses,

the Department of Interior recognized that Westmoreland Resources and the Crow Tribe were not far apart in their positions. The Department therefore sought to bring us together for a final negotiating session in Washington D.C. We and the Tribe agreed to do so under certain ground rules worked out in advance.

When all of us arrived in Washington we found that the Department had scheduled the use of various conference rooms for the three days that were to follow. As we and the Tribe began negotiations, shifting from one scheduled conference room to the next, we jointly began to notice that each successive conference room was smaller and hotter. Finally we were assigned a room so small and so hot that it became apparent that agreement should be reached quickly to avoid ending up in a closet.

We did, in fact, reach agreement with the Tribe which was overwhelmingly ratified by the Crow Tribal Council. In summary, the agreement provides for a royalty of 8% of the mine price on all sales not already contracted, a bonus of $500,000 and advance royalties of $628,000. In addition, if certain levels of production are not met, Westmoreland Resources must pay significant minimum royalties or, alternatively, release coal under lease to the Tribe. We also agreed not to supply a coal conversion facility on or within 50 miles of the Reservation without approval of the Tribe, except in the case of an existing agreement to which we were legally bound. The royalty rate is negotiable each 10 years.

Obviously we have suffered a difficult history, but our perserverance resulted in our meeting shipment obligations beginning on July 1, 1974, which date was established more than two years previously. There were no precedents for us to follow in putting the mine into production, and so almost everything we have done has been a "first."

A LOOK AT THE FUTURE

Legal Jurisdiction

The State of Montana set the national pace for detailed control over surface mining. It now appears fairly certain that an extremely comprehensive federal strip mining law will be enacted. With enactment of this law, we can foresee the distinct possibility of conflict between federal and state laws, as well as the administration thereof. The issue is complicated when the coal is owned and leased by Indian Tribes, which have been increasingly seeking control over the development of their resources. And the Department of Interior in the discharge of its obligations to Indians appears more and more inclined to grant control to the Tribes. Under these conditions it is logical to expect a jurisdictional confrontation with the coal producer in the middle. Three parties claiming legal control over a coal mining operations in untenable.

Agency Administration

With the enactment of the Montana Strip Mining & Reclamation Act and a federal law, there comes a mandate for specific and detailed preplanning. It is no longer possible for an operator to submit general plans, which allow the operator to react to

fluctuating cost, market and field conditions in a highly flexible manner. To counteract this loss of flexibility an operator must plan for all exigencies at least one year in advance, which necessitates most thorough environmental study so as not to get caught unaware. While we recognize benefits to preplanning and environmental study well in advance of mining, there are also potential drawbacks from almost any perspective to rigidity.

Under strip mining laws the administrative agencies flexibility, and their ability to grant us flexibility, is limited by the laws. Within this context we feel that the State of Montana has been equitable and fair in its regulation of our activities. But harder days undoubtedly lie before us, because we only started mining on July 1, 1974 and it would be in the mining phase that one would expect to encounter the more difficult problems. This is not to say we haven't had minor grievances in the past. If we have disagreed, we have always found the state agency would listen to our case and respect a well-formulated and well-documented argument.

A word of admonition is in order as we look to the future. It is amply clear that increasingly federal and state agencies will, and are already, increasing their authority over mining and reclamation down to the smallest detail. The industry will need, if it doesn't already, permission even to fertilize its reclaimed lands. With this authority comes a grave responsibility. The agencies must employ regulatory personnel who possess the highest possible degree of skill and experience. To do otherwise is an abrogation of this responsibility. If we are going to be closely regulated, we have the right to count on fulfillment of this agency responsibility. But also, remember that in a sense agencies and coal producers are partners required by law to achieve a common goal, which is the full reclamation of the land. So long as agencies have the final say in this partnership, that goal may not be met if agency personnel are improperly qualified personnel. There is much riding on the ability of both the agencies and coal producers fulfilling their responsibilities. Both need not only scientific, but also legal skills. It is imperative that agency decisions pursuant to various laws are properly based. We will not consider it a favor if improper enforcement or interpretation on their part leads to suit, which results in harm to us.

Taxes

The Montana Legislature recently enacted a severance tax for sub-bituminous coal amounting to 30% of the mine price less production taxes. It also enacted a gross proceeds tax, which in our case is 5.4% of the mine price. This rate of taxation raises serious doubts as to the competitive sales position of Montana's coal mines. Actions of foreign oil and gas producers, the United States Congress, the federal government and other states will be the determining factors in our long range competitive situation.

Inflating Capital Costs

Although neither peculiar to mining Indian coal nor mining in Montana, there has been an alarming rise in the cost of a mine. Costs of plant, equipment and rail construction have

probably doubled in the last two years. Inexpensive strip mining is a thing of the past, and prices of the coal will be increasing dramatically merely keeping up with costs. Under Montana's new tax structure, the rise in prices will be greater than for coal produced in other states.

CONCLUSION

In conclusion, it should be abundantly clear that obstacles, frustrations and challenges remain not only for Westmoreland Resources, but also for any prospective coal producer of Indian coal in Montana.

* * *

FEDERAL COAL DEVELOPMENT POLICIES AND THE ENVIRONMENT: NEPA AND BEYOND

By John D. Leshy*

INTRODUCTION

Any discussion of the development of the Fort Union coal field must sooner or later focus on federal policies, since like it or not, the federal government wields tremendous power in shaping the pattern of coal resource development in the Northern Plains. Much of this authority stems from the simple fact that the Interior Department directly manages more than 60% of the coal reserves in the area (including 55% of the strippable coal in Montana). (12) Furthermore, the interspersed private, railroad, state, federal and tribal mineral and surface ownership extends federal authority, because development of privately owned resources usually requires some form of federal approval.

While many federal policies -- like EPA's air and water quality regulations -- may have an important effect on private actions to develop Fort Union coal, this paper will focus directly on the federal public land and mineral resource management decisions. And, while an effective national program promoting the conservation of energy could all but eliminate the need for Western coal resources, this paper assumes that we will continue our enormous energy waste, and increasingly exploit Western coal resources. There are, however, hopeful signs of change. Although projections of dramatic increases in the use of Western coal are based on a supposed enormous increase in the use of bituminous coal for electrical generation, in 1974, total coal consumption for this purpose rose only about one half of one percent over 1973, from 387 to 389 million tons.(3) Conservation has already worked and it, coupled with the expected revitalization of the Eastern coal industry, could forestall reliance on Western coal for decades.

Directly or indirectly controlling most of the region's coal, the federal government has a unique opportunity to ensure orderly, environmentally sensitive development of the Fort Union coal resource. Unhappily, environmental considerations have not yet become a primary component of federal policymaking in the region. There is talk of reform, but to date federal coal development policies seem to be a replay of the policies which have led to the environmentally destructive Four Corners power development in the Southwest. For example, in 1970 the Bureau of Reclamation took the lead in a joint government/industry study of the development of regional coal resources for thermal electric power generation.(11) This so-called North Central Power Study (NCPS) proposed massive strip mining and the construction of mine-mouth plants to generate some 53,000 megawatts of electric power, with scarcely an acknowledgement of the tremendous environmental impacts involved. There was almost no attempt to involve environmentalists, competing ranching and other interests, or state and local governments. There was no recognition of the

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dramatic and unparalleled socio-economic as well as environmental changes which would be wrought, in a terribly compressed time frame, on a largely rural, arid region.

Wrong-headed and one-sided as the study was, it was useful, for it demonstrated the "worst case" scenario and awakened significant segments of the populace in the affected areas to the breadth of the possible development. Assuming that the myopic approach manifested in the NCPS has been abandoned by the federal government, if not by all segments of industry, the question still remains: To what degree will the federal government take environmental considerations into account in federal coal management in the region? The remainder of this paper examines this issue.

THE NATIONAL ENVIRONMENTAL POLICY ACT

NEPA is, of course, the most basic and generally applicable federal environmental law. Congressional purpose in enacting it was, simply stated, to build into the decisionmaking process a detailed, careful consideration of environmental impacts and costs. While NEPA's most important device is procedural -- the environmental impact statement (EIS) -- Congress clearly wanted to change basic bureaucratic processes and attitudes regarding the environment, and ultimately to affect the substance of decisionmaking.

To date, the federal government's implementation of NEPA in the Northern Plains region has been abysmal, as a matter both of form and substance. Several major federal coal leases were entered after NEPA's effective date without any attempt to comply with the EIS procedures.(7) NEPA statements have been prepared on significant mining plans only reluntantly, under pressure from NRDC and other groups. Litigation brought by NRDC, EDF and others has attacked the failure to prepare EIS's on a series of ten-year industrial water options granted since NEPA by the Bureau of Reclamation to ten energy companies for some 400,000 acre feet of Bighorn River water.(5) The Department of the Interior finally prepared and released an EIS on the overall federal coal leasing program last year, but it was almost universally criticized as severely inadequate. NRDC filed 160 pages of detailed criticisms; The Institute of Ecology's multidisciplinary review team found the draft shockingly deficient in all respects, and the EPA gave the statement its lowest ("inadequate") rating. The Department did not enhance its credibility when an Assistant Secretary conceded, on the day the EIS was released, that the statement had "major weaknesses" and a "very thin analysis".(8) The Interior Department has resisted the application of NEPA to the preference right leasing provisions of the Mineral Leasing Act, and that too is being contested by NRDC litigation.(10) Finally, the Department has resisted preparing an overall EIS on federal policies in the Northern Great Plains, by contesting a Sierra Club lawsuit seeking such a statement.(17) In all, the federal government has either ignored NEPA or only grudgingly applied its procedures to its Northern Plains development activities.

NEPA is a broadly applicable statute, establishing a framework for assessing environmental impacts at all levels. NEPA's basic objective is that every major action, every policy choice which has significant environmental consequences, must be fully discussed in an EIS addressed to the appropriate level of decision-

making. The failure to apply NEPA consistently here has severely limited NEPA's effectiveness and contributed to the aimless, confused quality of the Interior Department's decisions.

Starting with the broadest, most basic policy issues, we support the Sierra Club's attempt, through litigation, to require an overall EIS on the federal program to develop the coal resources of the Northern Great Plains. Such an EIS can explore fundamental, threshold questions of appropriate federal policy in this area -- questions that are nowhere being systematically addressed by the government. What are the major energy alternatives to increased reliance on Western coal? What are the cumulative environmental impacts of federal coal development in this region? What are the environmental tradeoffs in using Eastern versus Western coal? To what extent should Western coal-based synthetic fuels be emphasized in Northern Plains coal development? What are the areas in which additional data or further technical studies are needed before any development can proceed? What are the environmental impacts of alternative federal policy choices apart from those relating directly to coal leasing?

The joint federal/state Northern Great Plains Resource Program provides a starting point for such an assessment, but is neither designed nor claimed to be such an environmental impact analysis.(12) Except for the NGPRP, the federal government has exhibited no willingness to assess the environmental impacts of the various alternative answers to these questions. The coal leasing program EIS, consisting largely of a generalized discussion of environmental impacts of coal mining, virtually ignores these fundamental questions. The Project Independence Blueprint merely points out their existence. In short, a systematic, focused treatment of these issues is sorely needed.

The next level of policy issues relates specifically to federal coal leasing. Here the federal coal leasing program EIS needs to be redone, to address directly the possible alternative federal coal leasing policies, and to relate the federal policy choices in the broader regional impact analysis described above to the adoption of a specific federal coal leasing policy. Issues needing attention at this level are: What are the federal coal leasing options and the environmental impacts of each? What are the different management options for a new leasing system? What is the proper analytical framework for assessing rehabilitation potential? What are the environmental impacts of each option for managing existing federal coal leases and dealing with existing preference right lease applications? What are the government's information gaps on the environmental impacts of each option, and how can they be alleviated? The draft coal leasing program EIS released last year admittedly fell far short of the mark in treating these questions.

Finally, NEPA has a useful role to play at the more local level, in connection with leases, permits, mining plan and right-of-way approvals, and other site-specific actions. Here individual EIS's can fruitfully analyze important "on-the-ground" issues which cannot, because of site-specificity, be coherently addressed in an overview statement. It is important to note that the authoritative National Academy of Sciences study of Western coal land reclamation (which, astoundingly, was not even cited,

much less discussed, in the draft coal leasing program EIS) concluded that the potential for rehabilitating any surface mined area in the West is "critically site-specific".(9) Such variables as the soil, climate, water quantity and quality, and topographic conditions affect the mining and reclamation processes and determine rehabilitation potential. I am happily able to say that here, in contrast to its handling of the broader policy questions, the Interior Department is at least beginning to formulate a reasoned analytical approach. While the site-specific EIS's produced so far have varied widely in quality (one has received an "inadequate" rating from the EPA), some have at least identified problem areas and discussed alternatives in a systematic way.

Even where NEPA's procedures have been followed, the environmental impact evaluation has remained disturbingly aloof from the substance of decisionmaking. A single example illustrates the point. The federal coal leasing program EIS stresses that it is of "great importance in the West" to mine in a northeast-southwest direction to align the spoil piles to expose the least surface to the south and west because south and west slopes are hotter, drier and harder to revegetate.(15) But in recently-approved major mining proposals for federal coal, this factor is not even mentioned, and the mines involved are not aligned in the recommended direction.(14, 19) The substance of the EIS is not, in other words, being integrated into on-the-ground decisions. This failure compounds the damage caused by the Interior Department's reluctance to implement NEPA's procedures fully.

BEYOND NEPA

Looking broadly at the federal role in Fort Union coal development apart from the application of NEPA, the Interior Department must restructure its entire approach to public land and mineral management. The federal philosophy which was prevailed since the early 19th centry has been to open up the West, to subsidize settlement and development, and to promote in every possible way the exploitation of Western mineral resources. In mineral management, this has meant giving private mining and energy industries the initiative and providing them with whatever leases and permits they wanted. The rights and interests of the larger public, both in the West and elsewhere, were seen as identical or otherwise were subverted to that objective.

This situation can no longer prevail. The increasing sophistication and awareness of states and local communities of the serious impacts that rapid resource development has on local areas, the notion that the public lands and resources are to remain under public control and many other factors have combined to invalidate the notion that continued untrammeled exploitation is necessary or desirable.

The federal government must thus seize the initiative back from industry. The latter's goal of maximization of short-term profit inevitably means that it will usually seek to protect the environment only to the extent the law requires, and otherwise to avoid as much cost as possible, especially during difficult economic times. There is little incentive for companies to avoid areas where the ecological balance is fragile or where other valuable uses would be destroyed. In addition, energy companies

usually do not accept the obligation to consider or mitigate the cumulative impacts of their energy development activities. Finally, complete prevention or mitigation of all environmental damage is impossible in any area. In short, private industry does not respond appropriately to the environmental and social costs of coal production.

By contrast, the federal government has the incentive and the authority to shape the pattern of development in the most environmentally sound fashion. To do this, land use and resource planning is required, integrating mineral management into an overall planning process. The joint BLM-Forest Service effort in the 900,000 acre Decker-Birney planning unit so far represents a laudable attempt to provide detailed information for making land use and resource allocation decisions, with state and local government and public involvement, in a multiple use framework.(2) It is the kind of land use planning which should be done on every acre of public land before there is a major irreversible commitment of public resources to development. It remains to be seen whether the Decker-Birney study will ultimately result in adoption of a land use plan and, more importantly, whether it is a prototype for future planning, or merely an aberration.

We have been told for years that the BLM's long-awaited Energy Minerals Allocation Recommendation System (EMARS) is designed to provide a rational, comprehensive, planned approach to questions of when, where, and how much to lease. Perhaps EMARS is the answer, but I have two basic reservations about it. First, the system itself has never been fully explained. The 700-page draft coal leasing program EIS, which might have been expected to set forth the workings of the system in some detail, dismissed it in less than four pages. The distinct impression created is that EMARS is not yet a well-defined, coherent program. This impression was reinforced when the Assistant Secretary of the Interior conceded that "the weakness of this draft (coal leasing program EIS) reflects the general state of our development of the new coal program."(8)

My second reservation about EMARS is that its existence only underlines the federal government's inexplicable emphasis on further federal leasing. Practically all the federal government's bureaucratic energies seem to be devoted to a single goal: leasing more Western coal. This flies in the face of overwhelming evidence that further federal leasing at this time is neither necessary nor desirable. Consider the following:

(A) The Department has ignored the fact that there are, according to the U.S. Geological Survey, approximately 22 billion tons of federal coal already committed to private developers; this sum should be contrasted with 1972 coal production from federal lands, which was approximately 10 million tons.(15) Viewed from a strictly regional perspective, the NGPRP draft report gives the latest industry expectation for coal production from all sources within the region for 1980 at 143 million tons per year. (12) At this rate it would take 68 years to exhaust simply the federal reserves already under lease in the region (some 9.8 billion tons). At the NGPRP's most likely year 2000 estimate of production from all sources in the region (some 362 million tons per year), it would take 27 years to exhaust just the federal

reserves already under lease in the region.

Apart from the federal coal under lease, enormous amount of coal have been leased to energy companies by states, Indian tribes, railroads, and other entities. One study put the number of state, private and Indian coal acres under lease in the four state Northern Great Plains Region at over 1.8 million acres, or 36 billion tons of reserves, if we assume that such lands contain an average of as much coal as the leased federal lands (some 20,000 tons per acre).(12) Considering these other sources as well as federal coal already leased, another U.S.G.S. analysis suggests that the recoverable federal coal reserves already committed to development will last for 565 years, at the estimated 1975 rate of production from federal lands.(15) In short, even with full recognition of utilities' need for long-term commitments of coal supplies to justify large capital expenditures for coal-fired electrical generation plants, no additional federal leasing is required for several years.

(B) The Department has ignored the accumulating evidence that the use of Western coal poses more problems than it solves. Estimated reserves of so-called "low sulfur" Western coal are reduced dramatically if the calculation is based, as is proper, on an equivalent heat value (i.e., per BTU) basis rather than on the traditional but misleading per weight basis. Conversely, considered on a BTU basis, the Eastern U.S. has substantial low sulfur coal reserves. This leads many responsible observers, including the Environmental Protection Agency, to conclude that the relatively high moisture, high ash content and low BTU rating of Western coal makes it unlikely that its net sulfur oxide production would be substantially less than higher sulfur Eastern coals. Even the Executive Vice President of the National Coal Association recently agreed that the low sulfur content of much Western coal is a "delusion".(18)

(C) The Department has ignored the exceedingly primitive state of the art of surface mined land reclamation in the arid and semi-arid West. All available scientific studies call for substantially increased research efforts before reclamation can become a predictable activity.(9) There is a real risk, in other words, that large forbidding "national sacrifice areas" may be created by leasing and mining in the West before it is known whether rehabilitation of the disturbed land is possible. Even stringent enforcement of federal strip mining legislation cannot accomplish the impossible.

(D) The Department has ignored the several other important advantages in using Eastern coal: The East is located much closer to the largest markets, thus conserving scarce diesel fuel and requiring fewer railroad cars. It has much greater water resources for rehabilitation of surface-mined lands and for coal-related developments such as gasification plants. And socio-economic impacts could be more easily mitigated than in the sparsely populated West.

(E) The Department has ignored the substantial delays which will inevitably occur in opening new mines because of material shortages and long lead times required for the construction and delivery of new mine equipment. For example, a recent

government-sponsored study concluded that the current four to five year backlog of large capacity draglines effectively prevents the development of new maximum-efficiency mines, beyond those already announced, before 1979.(1)

(F) The Department has yet to weigh the tradeoffs between surface and deep mining of these coal reserves in any systematic way. There have been significant recent advances in underground safety and mining techniques. The simple fact that only 3% of the nation's recoverable coal reserves are strippable requires that the deep mining alternative be more carefully considered. In fact, an internal Department study warned recently that extreme reliance on Western strip mined coal could exhaust strippable reserves in the West in twenty years, creating a "boom-and-bust" syndrome with intolerable socio-economic and environmental consequences.(4)

(G) The Department has ignored the potential hazards posed by the chemical contaminants -- including substances with carcinogenic and otherwise toxic properties -- Western coal contains. Insufficient information has been developed about the consequences of burning coal containing varying amounts of these so-called trace elements.(15)

Unfortunately, although a careful considersation of any one of these pieces of evidence would dictate extreme caution before launching any new federal leasing program, all indications are that the decision to do so has already been made and that the foregoing evidence will continue to be disregarded. The sad truth is that federal policymakers have yet to articulate the reasons behind their policy of more federal leasing now.

In my view, the most pressing issue is not how can we expedite new leasing, but how the Department should regulate development on existing leases, and how it should dispose of the hundreds of preference right lease applications which could open up another two-thirds of a million acres (and 7-10 billion tons of coal) to development.(15) Are we to assume, as the Department of the Interior apparently does, that all these leases and lease applications will be developed, and that over a million acres of federal coal lands will be mined, primarily by stripping? The magnitude of such a development is staggering. By the year 2000, the 53,000 megawatts of the North Central Power Project would consume only about a third (6-8 billion tons) of the 22 billion tons of the federally-owned coal the Interior Department considers already in private hands and committed to development.(6, 11)

I believe that the Department must not wash its hands of any attempt to prohibit or control development of currently outstanding leases and permits. These leases and permits reflect past mistakes in mineral management policy. Many of them may have been unwisely or illegally granted, without the appropriate environmental analyses, or pre-lease technical examinations. Many resulted from prospecting permits granted in areas that were almost certainly known to contain coal. Most have been held for speculation without any development in apparent violation of the diligent development requirements of the Mineral Leasing Act. Most importantly, many are in areas which may be environmentally unsatisfactory to mine because of topography, climate, soils,

competing users, the presence of unique archeological or historical sites, or other similar conditions.

Amazing as it may seem, the Department has just recently undertaken a systematic effort to determine the ownership of coal and surface resources in Western coal fields, and to inventory existing leases. Only when such studies are completed will the federal government know, for the first time, precisely how much coal it controls, and where, and how much is under lease, and where. Concomitantly, only in the last few months has the Department considered putting teeth in the express requirement of the Mineral Leasing Act that there must be diligent development and continuous operations on existing and new leases. A proposed definition of diligent development was only unveiled by the Department in December of last year. We have no inkling when the proposed regulation will become final and fully applicable.

The steps taken with respect to existing leases have clearly been subordinated to developing a program for new leasing. In my view, this constitutes a reversal of priorities. Until it is known how much, where and under what conditions the many billions of tons of already leased coal are to be developed, no rational decisions can be made about future leasing. Rather than rush to open up new areas, the Department should concentrate its limited manpower on developing a reasoned policy for treating existing leases.

This policy must come to grips with the difficult issue of defining where development is appropriate. Unitially, the Department must publicly recognize, as it has privately conceded, that many of the leases and permits already granted are in areas where mining is environmentally unacceptable. More importantly, the Department must begin to formulate criteria for predicting rehabilitation potential of lands already under lease. An analytic framework for such a predictive system was recently proposed in an excellent technical report by Paul E. Packer of the Forest Service.(13) Unfortunately, his method, so far as we can tell, has not even been considered by the Department.

Existing leases in areas where the environmental impacts of mining are unacceptable pose a difficult problem which must be met head-on. The Department must use its condemnation power, its regulatory authority over mining plants, and its soon-to-be-obtained authority under the Surface Mining Control and Reclamation Act to prohibit development of such leases.

In my view, new leasing is appropriate for the foreseeable future only in order to continue ongoing operations or to trade new leases in environmentally satisfactory areas for existing leases in unsatisfactory areas. If legislation is needed to provide additional authority for shaping the development of existing leases in an environmentally sound way, then legislation must be drafted and submitted to Congress. So far the Department has manifested no willingness to examine or test its existing authority, much less to identify gaps and shortcommings and propose remedial legislation.

The core of a management approach to existing leases should be the concept, mentioned earlier, of integrating mineral manage-

ment into an overall public land and mineral management process. It is noteworthy that Senator Metcalf has reintroduced his Federal Coal Leasing Act Amendments of 1975 (S. 391), in approximately the same form as it passed the Senate last year. A similar reform has been introduced by Representative Mink in the House (H.R. 3265). Among other things, these proposals would allow new federal coal leasing only in areas which have been included in a comprehensive land use plan, and where the proposed lease is consistent with such a plan. While adoption of this approach would be a valuable beginning, I don't believe it goes nearly far enough since it does not deal with the billions of tons of coal, and hundreds of thousands of acres, already under lease.

Except for a limited exception based on ongoing operations or overriding need, I would propose generally prohibiting development of existing leases in any area until that area has gone through a land use planning process, with public involvement, and the proposed development is determined to be consistent with the plan. Federal planners must not assume that development of existing leases will inevitably occur. Thus their plans can and should recommend prohibition of development of an existing lease in appropriate circumstances. Upon such a recommendation, the Department has several options under existing law. It can cancel the existing lease if it was improvidentaly or illegally granted or held, or condemn the leasehold, or trade this lease for leases in other areas where mining is acceptable.

Formulating and implementing a management strategy for dealing with existing leases is a massive task, and places severe demands on limited federal funds and personnel. Squandering these resources in an ill-conceived major new leasing effort is a serious mistake.

CONCLUSION

To mix unfortunately accurate metaphors, despite all the heat generated by the growing concern over federal policies vis-a-vis Fort Union coal development, the federal government has, by its continuing failure to come to grips with the policy issues discussed above, done nothing to clear the air. Federal compliance with the National Environmental Policy Act remains woefully inadequate, and the federal coal leasing program remains a mess, with a strong thrust toward further major leasing masking the confusion and disarray over proper policy toward existing leases and permits. The Department of the Interior must put its management policies on a firm footing and repair its seriously damaged credibility, by suspending all plans for new leasing and implementing a system for controlling existing lease development along the lines I have suggested here.

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NORTHERN CHEYENNE FUTURE

Dr. Alonzo T. Spang, Sr.*

INTRODUCTION:

This paper, on the Northern Cheyenne Future, is presented for the sole purpose of shedding some light on their plight. It is no scientifically prepared, although various studies, inventories and investigation actions, are cited. Rather, it is presented as a "people view", to interpret and analyze their situation and the conclusions made.

The Northern Cheyenne feel they have been overlooked, neglected and ignored in the many studies so far conducted. For example, the Westinghouse Study for Montana Power very clearly and without any pang of guilt, states no one on the reservation was included in their study.

The paper, then, is to share some thoughts about the Northern Cheyenne's fight to insure their future.

HISTORICAL AND DEMOGRAPHIC DATA:

In order to gain a better perspective of the Northern Cheyenne Reservation, it is important to have some knowledge of its history and demographic data.

A. Establishment of the Reservation:

The Northern Cheyenne Reservation was established by Executive Order in 1884 by President Arthur. This comprised a land base of approximately 271,000 acres. Then, in 1900, President McKinley, by Executive Order, extended the eastern boundary of the Reservation to the Tongue River. This resulted in a total reservation land base of 444,157 acres. The Reservation is located in southeastern Montana, about 100 miles east of Billings and about 40 miles north of the Montana-Wyoming border.

B. Ownership of Land:

Approximately 434,000 acres is owned either by the Tribue or individual members. About 10,000 acres are in fee status with some of it owned by Tribal members. Thus, well over 90% of the reservation acreage is owned by the Tribe and individual members.

C. Description of the Reservation:

1. Topography

The reservation lies within the area described as the unglaciated portion of the Missouri Plateau, which is a part of the Northern Great Plains Province. The land surface is deeply dissected and has very pronounced features of relief. The

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altitudes range from 4730 feet (MSL) near Bull Creek Lookout Tower in the southwest portion of the Reservation, to about 2920 feet (MSL) on the Tongue River north of Ashland. This gives a relief of about 1810 feet. The central portion of the Reservation is an upland plateau which rises 800 to 1000 feet above the adjoining country, and is underlain by relatively flat-lying beds of Fort Union Formation of Paleocene age. Much of the upland is covered by pines, while cottonwood and box elder trees predominate along the streams.

The pine trees are ponderosa pine and constitute one of the major resources of the reservation. The Tribe depends greatly on the income generated from this renewable resource.

2. Climate

The climate of the Northern Cheyenne Reservation is continental and semi-arid and is characterized by abundant sunshine, low relative humidity, moderate wind movement, light precipitation, and wide daily and seasonal temperature variations. The winters are moderately severe with cold waves occuring every winter, but varying in intensity. During the summer months, temperatures frequently reach into the 90's and occasionally over 100 degrees. Although hot, the weather is not oppressive because of the low humidity. The frost free growing season is generally between 100-120 days on the Reservation.

Rainfall in the Reservation area varies from a low of around 12 inches to a high of approximately 17 inches. Precipitation is also variable. Data, at Ashland, shows a normal precipitation of about 16 inches per year with minimum and maximum figures of 9 and 24 inches, respectively. However, precipitation falls mostly in the growing season thereby increasing its effectiveness for cropland, range plants and soil formation.

Snows are heavy while high winds sweep the region especially in the wintertime and blizzards are common. Historic records on the Reservation show annual snowfall, generally, between 40-60 inches. However, snowfall in the plains blows away most years collecting as drifts in draws and leaving the fields and roads bare.

3. Vegetation

Vegetative types found in this area are typical of those found in a 12" to 14" rainfall belt. Most of the vegetative cover consists of short grasses and shrubs. In the rougher breaks and rocky slopes, ponderosa pine and junipers are common. On gentler slopes the vegetation consits mainly of blue grama grass, blue bunch wheatgrass, needle-and-thread grass, dryland sedges and western wheatgrass. Some big sagebrush grows on upper benches, and silver sage grows in swales.

There are several different varieties of wild berries, fruits and edible plants.

D. Population:

The resident population of the Northern Cheyenne Reservation

is approximately 3300. Of this total, 2880 are Northern Cheyenne. Overall, a total of 3600 Cheyennes are enrolled. The population is a relatively young one with 55% below the age of 21 years. A labor force of 1700 exists. The rate of unemployment is 25%.

COAL ACTIVITY:

At present, there is no coal production activity on the reservation. On March 5, 1973, the Northern Cheyenne Tribal Council enacted Resolution No. 132 (73) which directed the Secretary of the Interior to cancel and terminate all coal leases and permits. This affects five (5) groups. June 4, 1974 Secretary's decision did not cancel or terminate permits and leases; it gave Cheyennes more direct involvement i.e. leases and approval of mining plans.

Currently, the Reservation is surrounded by coal activity. Briefly, to the northwest, the Westmoreland operation is producing Crow coal; to the south and southwest, the Decker Coal operation is found; and to the north, the mining operations of Peabody and Western Energy; as well as Montana Power's Generating Units 1 and 2 are located.

Although no coal activity is within the exterior boundaries of the Reservation, the surrounding and engulfing activity is affecting, and will continue to affect, the Northern Cheyenne.

Some of the effects are these:

1. Housing--several non-Indian and non-Cheyenne Indian workers at Colstrip live in Lame Deer or on the reservation. Housing is a problem for all.

2. Transportation of Equipment--equipment for the Colstrip operation is transported through Lame Deer creating a traffic problem and maintenance of roads.

3. Trespass of non-Cheyennes. The Tribe has a permit system for non-members and this is violated by those who traverse the reservation without holding a valid permit. This, no doubt, will become more pronounced in the future as the work force at Colstrip increases.

Overall, the Cheyenne are very concerned about the impact which has resulted and which will result from on-going and expanded coal activity.

MAJOR ADVERSE IMPACTS TO RESERVATION:

There are several areas which will adversely affect the Cheyenne as coal activity increases and developes. However, only those considered major will be discussed here. These include the following:

1. Ground Water Pollution and Loss: When this acquifer is removed, the quanity and quality of water will be adversely affected.

2. Loss of timber and grazing resources through air

pollution particulate and acid rains. Colstrip Units 1 and 2 will emit pollutants which will affect these. The wind pattern is such that these pollutants will be deposited on Reservation timber, grass, etc.

3. Impact on the Human Environment:

The human environment is made up of numerous systems including industrial, agricultural, residential, commercial, educational, recreational and political, as well as systems of cultural amenities, communications and transportation. All these systems are interrelated and any change within one is reflected by corresponding secondary changes in the others. It is, therefore, apparent that intensive large scale development in a predominantly agricultural region would have far reaching secondary repercussions.

The transition from an agrarian to an urban-industrial life style could be very rapid in some locations. In these areas, the basic employment patterns would be changed, the traditional culture values disrupted and existing land use relationships altered. Well-planned coal development could perhaps benefit some eastern Montana communities whose population had declined rapidly in recent years, but such benefits might be short range benefits within the reservation communities.

Industrialization creates a population increase which creates a greater demand upon and requires greater expenditures for all government services, including police and fire protection, sewage and solid waste disposal and water. It also requires a larger number of educational facilities, an expanded political system, and a rethinking and modification of the entire transportation system. It means a greatly increased load on all existing recreation facilities and a demand for more.

4. Human Resources.

The name "Cheyenne" invokes an image of the proud warrior. This pride is what has perhaps sustained the Cheyenne people through the many decades of Indian - non-Indian contacts. Isolation, lack of educational opportunities and employment, and prejudice from the surrounding white communities have contributed to formation of a strong bond among the Cheyennes and has fostered intense retention of the Cheyenne way of life. Even now, with the presence of good schools, increased employment, highways and other communication systems, we the Cheyenne have retained our culture. This is evidenced by our sponsoring numerous Pow Wows, ceremonials, and the "passing on" to our young, our legends and stories which compose our history.

Without question, the influx of non-Indians (which influx will "peak-out" as coal mining enters its production phase) will have a tremendous impact on the culture of the Cheyenne. It is conceivable and not farfetched that this could bring about the demise of Cheyenne culture and of Cheyenne life style. The Cheyenne could, and would, become a minority in their homeland.

As young people have a tendency to imitate their peer group, young Cheyennes undoubtedly will copy the customs

and habits of the invaders. It is doubtful that the adult Cheyennes could successfully oppose such changes.

Northern Cheyenne Indians, traditionally, feel a deep sense of security through living on the reservation. Therefore, they may sense a great loss through witnessing a strip mining operation which causes physical changes to the familar landscape and affects surrounding lands, waters, and communities. With the likelihood of increased per capita finances, it is anticipated that most members will gain incentives to learn skills, receive training, or further their education and will consider the advantages of the increased income in a positive manner.

The psychology of sudden cash, readily available could create a prime inducement for narcotic drug addiction. Though it is thought that the present educational program, already being implemented, will continue to deter drug abuse and discourage entry or infiltration of drug pushers.

Alcohol, by tribal ordinance, is not presently allowed on the reservation. Nevertheless, it presently constitutes an acute problem. The increase in per capita income might amplify the existing problem, but could also solve some of the underlying causes of alcoholism.

Without question, we can predict that:

A. Culture change would be inevitable with an on-rush of non-Indian coal employees as non-Indians in the local communities would suddenly out number Indians.

B. Any influx of additional non-Indians without orientation of Indian customs and culture, would have a major impact.

5. Judicial, Prevention and Enforcement Services.

The Judicial, Prevention and Enforcement Services insures that law and order and protection of life and property is provided for all persons living within the exterior boundaries of the Northern Cheyenne Reservation. Coal development on the Northern Cheyenne Reservation could bring increased development of business and education facilities; more jobs available for the unemployed; improved living conditions; and medical facilities.

However, with the large influx of people coming to the reservation, jurisdiction over non-Indians would be one of the biggest problems to deal with. The applicability of appropriate laws for non-Indians will need to be determined, i.e., whether law violators can be tried under state or federal statutes.

The types of people who will be coming to the reservation may wish to live and function as individualists, or could be the type of people who want a voice in everything. This will produce greater strain on everyone.

With more money available, the crime rate will undoubtedly increase. Contraband such as liquor and dangerous

drugs may become more available.

With coal development on the reservation, conflict between land owners and other people will increase. Trespassing violations on privately owned lands, leased lands, highways, etc., will increase.

If industrial people build their own town, city, etc., a determination will need to be made as to whether they will abide by and be subject to a local law and order system; or be subject to the state and federal laws; also, if this new city wants a voice in tribal government or will they want to create their own.

There will be increased demands for varied recreational activities. Problems of trespassing on private or leased lands to hunt, fish, etc., undoubtedly will arise.

More pollution of all types will be generated--increased vehicular traffic will produce more exhaust; odor and noise pollution will increase; more garbage and sanitation problems will arise; polluting of streams will increase.

At the present time, a significant number of Cheyennes earn their income from ranching and farming. If coal development occurs, there is a very strong possibility these people will lose certain grazing areas.

In its concern, the Tribe has not been idly sitting by and letting things take their own course. They have in a sense taken the Bull by the Horns. They are currently involved in determining their destiny as follows:

1. Northern Cheyenne Research Project
2. Monitoring stations
3. Legal actions
   A. Air Quality concern
   B. Water Rights

CONCLUSIONS:

With coal activity encroaching on the Northern Cheyenne, the dismay expressed by the people can be summarized as follows:

1. Destruction of Cheyenne culture - the life-style of the people.

2. High influx of non-Indians into the Reservation. Cheyenne become a minority in their own homeland.

3. Traffic or vehicular problems due to increase in population.

4. Pollution of all sorts, i.e. human, cultural, air, sound, noise.

5. High concentration of people brings about an increase in crime related activities.

* * *

Fort Union Coal Field Symposium

"COAL GASIFICATION - MISSION IMPOSSIBLE?"

H. E. Sutherland*

Most Americans now realize that the United States is being squeezed between an increasing demand for energy and shrinking supplies of the fuels we most commonly use. We have come to know this problem as the energy crisis. It has been characterized as and effect created by the dwindling reserves of domestic oil and natural gas, lagging exploration and development efforts brought about by a lack of price incentives, inadequate refining capacity, overly restrictive air quality controls which limits fuel substitution, extravagant consumption, inefficient utilization and a host of others. No matter how we attempt to describe it, the energy supply situation is bewilderingly complex.

Today, I will discuss how Natural Gas Pipeline Company of America views this problem, what we have been doing about it and where we must now go in pursuit of its solution. Briefly for identification, Natural is the interstate gas transmission subsidiary of the Peoples Gas Company located in Chicago. It began operations in 1931 and was the first company in the U. S. to construct a long distance, large diameter, gas pipeline. Today, Natural operates approximately 11,000 miles of pipeline, supplying gas to 49 distribution companies who serve markets consisting of some 14 million people, throughout a ten state area. Currently, Natural supplies 75% of all gas used in the Chicago metropolitan area.

Needless to say, the supplies of natural gas, our largest source of domestically produced energy, is a matter of great importance to Natural and to this nation's goals for energy self sufficiency. It bears directly on total energy availability, the supply and price of other fuels, foreign policy and international relationships, productivity and lifestyles and environmental quality. Its increasing scarcity invites a condition of vulnerability.

Since 1968, the shortage of natural gas has grown worse every year. The American Gas Association recently reported that the proved reserves of natural gas in the United States dropped another 5% during 1974, marking the sixth decline in the last seven years. Proved reserves, including Alaska, now stand at 237 trillion cubic feet, their lowest level since 1956. The AGA reports also indicate that production of natural gas has dropped to 21.3 trillion cubic feet in 1974 after holding at a near constant level of about 22 trillion cubic feet for the four prior years. This marked the first significant decline in production since the association began estimating natural gas reserves in 1946.

Historically, the natural gas industry has experienced a very rapid growth rate due to the increasing demand for clean energy. However, in about 1970, the interstate pipeline companies voluntarily began limiting growth to preserve adequate supplies

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for their existing customers. This practice of curtailing deliveries has increased from about 286 billion cubic feet during 1971 to an estimated level that will probably exceed 2 trillion cubic feet for 1975. However, make no mistake, this has not resulted in an energy savings. In reality, those energy users who have been denied the use of natural gas have been forced to switch to alternate fuels. Past trends have indicated that any deficiency in domestic fuel supplies is usually made up through increased oil imports. The AGA estimates that in 1974, 2.8 million barrels of oil per day was imported to make up for the shortage of natural gas. Remedial action must be taken soon to change this trend.

Unfortunately, to date many of our leaders have directed their attention toward conservation and allocation as a solution to our energy supply problems. However, as laudable as the conservation ethic may be, it remains a mechanism for distributing ever-smaller supplies to an ever-growing demand. It does nothing to develop the new supply sources needed to move us closer to energy self sufficiency. We must develop other major domestic supplies of energy.

Throughout recent years, Natural has pursued a very broad range of gas supply programs to increase available supplies of pipeline quality gas. These programs include:

- Gas from the Arctic
- Gas from the offshore areas of Texas and Louisiana
- Gas from foreign sources imported as LNG
- Gas produced from liquid hydrocarbons
- Even gas produced from manure

While all these projects are moving forward, all these sources combined will still be insufficient to fulfill our estimated demands five to ten years from now and beyond. Therefore, other long term energy sources have to be considered.

Fortunately, this country has been blessed with the resource potential for energy abundance, if we are permitted to develop it. The coal reserves, of the Fort Union Region are, of course, a major part of that potential. In President Ford's words:

> "Coal represents one immediate and dependable answer to the question of how we solve our energy needs in this nation. Coal is America's ace in the hole".

For Natural, and many other major energy systems, the conversion of a portion of these reserves to pipeline quality gas is the most promising means of achieving our long range objectives and at the same time, lessens our dependence on foreign energy supplies. The Federal Power Commission's "National Gas Survey" indicates that the quickest way to increase gas supplies in the next decade will be through the development of coal gasification. They project that by 1990 gas from coal could be contributing from 3.2 to 5.1 trillion cubic feet annually. Although such estimates and projections may be optimistic, the fact remains, that the gas supply potential offered by the availability of coal gasification technology is very substantial.

At the present time, there are many major gas transmission companies actively attempting to develop coal gasification projects. Many of these involve coal reserves capable of supporting multiple plants. While only three companies have filed applications with the Federal Power Commission, there are at least three other companies actively engaged in completing the preparatory studies, and still others are in the process of formulation. The conclusion to be drawn from this is, throughout the gas industry, substantial interest and appreciation of the feasibility of coal gasification does now exist.

While coal gasification offers great opportunity to substantially supplement our ever decreasing natural gas resources, its growth to a position of primacy will not be easy. Nor is such growth assured. Many obstacles, both pending and proposed, could seriously impair the vitally important contribution that coal gasification can make toward stabilization of our energy programs. There are solutions to these obstacles but it will require the help and cooperation of Congress, a host of State and Federal governmental regulatory agencies, and, of course, the general public.

For the purpose of demonstrating a few of the types of problems involved in the planning of projects of this magnitude, I will summarize the major elements of Natural's proposed Coal Gasification Project in Dunn County, North Dakota. Natural's long range plans call for the construction of four 250 million cubic feet per day coal gasification complexes. The first of these is scheduled for initial production in 1982. Additional mine and plant units will be placed on line at 3 to 5 year intervals.

Before dealing with specifics, however, I would like to emphasize that, although each project of this type has its own specific set of problems, many of the issues to be discussed will apply to any of the Coal Gasification Projects being planned in this Region. This is primarily due to the major involvement of the Federal and State regulatory agencies in each Project of this type.

In 1971, Natural initiated investigations to identify the major coal bearing regions of the United States which could support a major coal gasification project. The major criteria used to evaluate these areas were:

1. the availability of adequate coal reserves sufficient to support a minimum of four coal gasification plants each having a capacity of 250 million cubic feet per day.

2. the availability of sufficient water supplies near the coal area.

The results of these investigations helped to focus our attention on the Fort Union Region of North Dakota as an area offering the greatest potential for development. Subsequently, Natural entered into a leasehold dedication agreement with a local North Dakota firm for the development rights to their interests in a 110,000 acre area near Dunn Center, North Dakota, containing an estimated 2.1 billion tons of recoverable lignite. The Federal government

controls the mineral rights to approximately 44,000 acres in this area. This Federal coal underlies privately-owned surface and is dispersed throughout the area in a checkerboard pattern. It will be necessary to acquire the rights to these reserves in order to develop the Project. Consequently, in October of last year, Natural applied to the Bureau of Land Management, requesting that the federally-owned coal rights be opened for competitive lease bidding. Most of you, I am sure, are aware of the many legal problems and environmental requirements that have effectively stymied efforts to develop a comprehensive coal leasing policy during the past three to four years. The Department of the Interior's ultimate coal leasing procedures, as well as lease terms and provisions will have a significant effect on the fate of many projects such as Natural's. Meanwhile, potential developers are being forced, due to the extremely long lead-time required for project development, to continue the planning process on faith. The expense and risk involved are not insignificant. Natural's goals for the continued development of its Dunn County, North Dakota Project, as well as the energy needs of this nation, require a timely resolution of this issue.

As noted earlier in the criteria developed for preliminary site selection purposes, water is as essential to coal gasification as the coal. All processes by which coal is converted into synthetic pipeline gas require relatively large quantities of water. In April, 1974, Natural applied to the North Dakota State Water Commission for a conditional water permit to divert 70,000 acre feet per year from Lake Sakakawea. That quantity will be sufficient for the operation of all four proposed plants. In support of that application, Natural has filed preliminary engineering and process design studies and the results of two preliminary environmental studies for the project. A public hearing on that application was held in December, 1974. At that hearing testimony was presented in the form of a letter from the Office of the Solicitor for the Department of the Interior, questioning the State's jurisdiction with respect to waters which form a portion of the boundaries of an Indian Reservation. Although Natural is not directly involved in this dispute, delays to the further implementation of this project could likely occur if the issue is not quickly resolved.

In January, 1975, Natural commissioned detailed studies directed toward the development of process and plant designs, reserve determinations, mine plans, and environmental assessments. These studies are necessary to provide supporting data to obtain the required local, State and Federal certification for the project. From review of existing codes and regulations, Natural now estimates that at least fifteen separate regulatory approvals will be required before the physical construction efforts begin. This regulatory process will require approximately 3 years to complete. The Company's stockholders investment may very will exceed $20 million before final permission to proceed with the project has been received from these governmental agencies.

There are, of course, many other issues which could be debated, such as the effects of currently proposed mined-land reclamation legislation, industry taxation at both the State and Federal levels, the need for financial incentives for these projects, the critical need for governmental assistance in establishing

priorities for the allocation of construction materials, to list only a few. To Natural these are issues which will be affected by the legislative process and, if adopted, our efforts can then be directed toward fulfilling those requirements. However, we have attempted to narrow this discussion to those areas where policy decisions are required from a coal conversion proponent's viewpoint. We recognize that the development of this vast new energy conversion industry will require a cooperative effort on the part of government, industry and the general public. State and Federal governments must provide leadership and encouragement. A few of the ways this can be demonstrated are:

1. Consolidate the regulatory requirements under one or two lead agencies. This will avoid duplication of efforts on the part of industry and the government. It will also remove many of the roadblocks to this necessary development by allowing these agencies to set fair and comprehensive standards, standards which can be anticipated and planned for. One example of a step in the right direction, was the recent announcement by Secretary Morton of an agreement between the Bureau of Reclamation and the Corps of Engineers regarding the sale of water from Missouri River Reservoirs. Similar action in many other areas is warranted.

2. The Federal coal leasing program must be reimplemented. The checkerboard pattern of Federal coal ownership in many areas precludes the development of private reserves in large projects such as coal gasification. In many areas private surface and private coal have been obtained for the development of specific ventures, however, the Federal reserves must be leased if these Projects are to proceed further.

3. A mechanism which allows private firms to conduct drilling and exploratory operations on private lands which are underlain by Federal coal reserves is necessary. The development, of this vast energy resource and these extremely costly projects, requires information as to the quantity and location of these coal reserves and the assessment of the environmental constraints that must be applied to their use. The government and industry must cooperate to develop this information.

Our mission, yours and mine, should we decide to accept it, will be to provide a technically sound, economically feasible, and environmentally acceptable means of distributing energy from this abundant natural resource to a vast number of American citizens. Natural, has accepted this challenge. However, its proposed project, and possibly many other like it, may self-destruct, unless appropriate action is taken now.

* * *

ARE THEY STILL MINING COAL?

John F. Ratchye, Jr.*

In the time that has passed since I acquiesced to Ed Zaidlicz's sweet talk and agreed to make what he refers to as a presentation, I have spent many hours thinking about what I should talk about. When I was pressed to submit a title for my talk, the Legislative Sessions in all of the states included in the Fort Union Coal Field were hard at work trying to outdo each other insofar as coal taxation was concerned, while simultaneously avoiding any possible accusation that they might be friendly toward our industry. There were some days when I felt that my coal mining friends and I were in a totally different world from that occupied by my friends in the legislatures. It was on one of those days that I decided to submit "Are They Still Mining Coal?" as the title for my talk and then to sit back and wait for the Symposium to see what the answer would be. As you all know, the answer to the question posed is resoundingly in the affirmative. Yes, in spite of what our legislative bodies have done, those coal mines that were in production in 1974 are still operating. I am optimistic that those mines presently on strike will be back in production soon to make my previous statement 100% true. It is good that the mines in the Fort Union Coal Field are still mining coal, too.

Yes, it is good in my opinion, that Western coal is being mined. I am offering you my opinion in the sincerely held belief that I, as a coal miner, a taxpayer, a native of Montana, a father of four children, a resident of Wyoming, and a citizen of the United States, can see beyond the limits of the Fort Union Coal Field and catch a glimpse of something larger than my own self-interest. I have had some assistance and guidance in arriving at my present state of mind with regard to the development of the nation's huge coal reserves and I should like to share with you now some of the influences that I have felt.

In the years since the first Montana Coal Resources Symposium, which was held in Butte on October 9 and 10, 1964, there have been a large number of conventions, meetings, conferences, legislative sessions, and symposia that have treated with coal in Montana and the Fort Union Coal Field. I have been a participant in a few of these and today I am going to dredge up a few authoritative remarks made on occasions when I was present that influenced, or at least reinforced, my judgment regarding coal development.

In his message to the 1964 Symposium, Governor Babcock said:

> "In summation coal is one of Montana's largest underdeveloped natural resources. Increased utilization of coal for fuel and steam generation and as a raw material for the chemical industry would have a very beneficial effect on Montana's economy by providing additional jobs and creating new basic wealth."

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The entire meeting concerned itself with Montana's coal reserves, coal economics, coal research, and coal markets. One of the most memorable comments came from the late Harry Tibbs when he said:

> "Any fool can open a coal mine, but it takes a damn good man to run one without a customer."

A direct descendent of this first Symposium was the Montana University System Coal Research Council. The Council fulfilled a very real function with regard to Montana's coal resource over a period of several years.

Other conferences were held that concerned themselves with mined land reclamation rather than development. Montana's reclamation law grew out of such concerns and conferences.

Meanwhile, the coal remained in the ground for lack of Harry Tibb's all-important customer. In the late summer of 1969, three separate and more or less unrelated things occurred almost simultaneously that changed the nation's energy picture permanently. First, Illinois and some other states passed laws limiting the sulfur content of any fuel burned. Second, the midwest was confronted with the prospect of a shortage of natural gas for the oncoming winter. Third, coal mines in the midwestern coal fields were unable to produce a sufficient tonnage of low sulfur coal to supply the sudden demand. Coal burning utilities and gas burning industry looked west for an answer. The few existing mines in the Fort Union Coal Field responded by doubling, tripling, and even quadrupling their accustomed tonnage. Suddenly, western coal was a factor, not just an untapped natural resource. People, and politicians, got interested.

Thus, it came to pass that the Montana Congressional delegation and Governor Forrest Anderson co-sponsored the Montana Coal Symposium here in Billings on November 6 and 7, 1969. In the letter of invitation which was on the letterhead of the Office of the Majority Leader and signed by the entire Congressional Delegation, it was stated that:

> "Montana has some 221 billion tons of coal reserves including lignite, sub-bituminous, and bituminous coal. At least 14 billion tons are considered "strippable"; that is, subject to economic strip mining. There is abundant water available.
>
> We believe Montana's resources to be of immense importance to the economy of the state and to the nation's energy industries. So far, the potential has been too little recognized. The purpose of this Symposium is to inform coal users and Montanans that the potential is there and to prepare for its realization."

In his introductory remarks, Governor Forrest Anderson discussed the beneficial effect that cheap power had had on the economy of the United States. He continued to describe the future growth of the electric utility industry in the nation and in the western states. He went on:

"However, Montana has yet to receive a substantial share of the growing investment in coal fueled power plants. This is unfortunate for two reasons. One, our state is in need of new job creating capital investment. I have stated before that per capita personal income in Montana has declined from 113% of the national average in 1948 to 85% in 1958. Our working age population has declined from 86% of the total population in 1950 to 47% in 1968, resulting in a much narrower tax base.

These two factors mean that Montanans are simply unable to command the same level of goods and services as people in the rest of the nation. We tend to view this situation with indifference right now, for we are compensated by an environment and way of life that blunt the full effects. If nothing changes--if this economic decline continues--the future promises inadequate highways, schools, and medical and governmental services. The future cost of living in Montana may well be a prohibitively low standard of living.

The lack of investment in coal fueled power in Montana is also unfortunate because we have two very valuable resources, coal and water which are not being fully utilized."

In a discussion of the study of development alternatives, the Governor said:

"We may discover from such analyses that the state should give some tax or other consideration to projects that involve power plants within the state or perhaps even more to power companies that encourage industrial development through lower rates. Or, we may find that projects which are based on the long-standing tradition of merely exporting raw materials are not worth the total cost.

In any case, it is my desire that this Symposium mark the beginning of a reasoned examination and discussion of the myriad questions surrounding coal development. The practice of basing decisions on ignorance, myopic self-interest, and emotion has too long plagued our state."

Yes sir, Forrest said it all as Governor of a state with serious economic problems and a virtually untapped energy resource that the nation needed desperately. He appears to have been prescient if the report of personal income change by states from January 1974 to January 1975 that appeared in the April 14 issue of Business Week is true. The report indicated that Montana's personal income dropped by 7.2% in that inflationary period of time while Wyoming's increased 18.4%, the greatest increase in the lower 48. His rejection of "ignorance, myopic self-interest and emotion" as a basis for decision making was good advice then and certainly worthy of consideration by today's decision makers.

At lunch on the second day of the Symposium, Congressman Melcher, another co-sponsor, addressed the attendees stating among other things:

"Part of the cost of coal mining is reclamation of the land so that cows, sheep and deer still have a home.

Experience indicates that it will be surprisingly inexpensive."

He went on to say:

> "It means that our streams and lakes should be of the highest possible quality, free of the thermal pollution that often does irreparable damage to the balance of life, free of the poisonous chemicals and other pollutants that kill life in the water outright, and free of polluting garbage or sewage.
>
> It means finally that we can develop our coal reserves and at the same time keep our prairies and skies clear and clean, keep our livestock and wildlife alive and healthy, and preserve Montana's unique natural heritage."

He also expressed the thought that moving energy industries out into western states such as Montana had great potential because there is so much pollution of air and water in congested urban areas. This is one aspect of what Mr. Melcher called a "terrible imbalance" which has seen rural areas lose population and urban areas become more and more overgrown. He went on to say:

> "Rural and urban problems feed on each other. As the opportunity to have a decent living declines in the rural areas, people flock to the urban areas. It is a vicious circle which must be broken if this nation is to continue being the greatest on earth."

Yes, that 1969 Symposium had a profound influence on my attitude toward coal development. I found that I agreed wholeheartedly with the co-sponsors of the Symposium and they agreed with me on all of the important points regarding the development of coal in the Fort Union Coal Field. Of course, we have to remember that 1969 was a whole different world. At that time, the railroad speaker was from the Northern Pacific, one of the predecessors of the merged Burlington Northern. The Tony Boyle regime was in evidence at the Symposium in that Dick Boyle, the District President of the United Mine Workers was there, Antoinette Boyle, Tony's daughter and counsel for the United Mine Workers in the area also attended, and Joe Brennan, the economic expert for the United Mine Workers was in attendance. Things have really changed since then. You don't hear about the Boyles anymore and next time the United Mine Workers of American sit down to negotiate a contract with the Bituminous Coal Operators Association, Joe Brennan will be on the other side of the table as President of BCOA. Two new mines have opened up in Montana. One new mine has opened up in North Dakota. Five new mines have opened up in Wyoming, one of which has closed and many more mines have been announced.

In October of 1973 immediately following the Yom Kippur War, this nation's energy picture changed again drastically. The energy dilemma became the energy crisis almost overnight with the Arab embargo on oil. That winter many parts of the United States saw long lines at gas stations. Schools closed for lack of fuel to heat the school building. Factories closed for a lack of fuel for space heating. Schools closed for lack of fuel for their buses. Industrial plants closed for lack of process heat and

many areas had brown-outs because of a shortage of electricity. In the spring of 1974, with the oil cartel organized and functioning, these United States again were able to get all the fuel they could buy and the energy crisis disappeared for a lot of people. For those of us in the energy business, however, it was just a short respite until the next crisis.

On March 21 of this year, I had the extreme pleasure and privilege of attending "Coal Day At The White House' where my views were modified and broadened somewhat. This conference, which lasted all day, was attended by about 100 representatives of the coal industry, some utility executives, officers of labor unions, and a few representatives of the mining machinery manufacturing industry. There were a number of high level bureaucrats and cabinet level people from the Ford Administration. Vice-President Rockefeller opened the meeting by telling us that the Government was depending upon the coal industry to increase production as a very important part of President Ford's goal of national energy self-sufficiency by 1985. He expressed his admiration for President Ford saying that the President had the courage to make decisions that are not always popular with politicians today but that are in the nation's best interest in the long run. Rockefeller said that Mr. Ford is spending hard earned political capital in order to achieve national energy self-sufficiency. Another comment he made was that President Ford is seeking a balance between economic growth and protection of the environment. A number of speakers addressed the group regarding various aspects of the Administration's energy policy and the ability of the industry to answer the call. After dinner President Ford spoke informally. He stated that he had been unable to attend the meeting through the day but that he felt he knew what had gone on and, even if he didn't, he was going to tell us how he felt about developing the nation's coal reserves. He stated that the nation is extremely vulnerable while we are importing foreign oil. This vulnerability extends throughout the economy and into the national security. He stated that we are in worse shape with regard to imports nowthan we were in October, 1973 when the fuel embargo began. He said at that time we were importing approximately 5 million barrels per day of foreign oil. He said that now our energy needs have increased and we are importing 6 million barrels a day and our domestic production has not increased. He considers this to be a step backward. He would like to have coal increase its production to make the nation independent of imports. He would like to have coal come into play to the extent that whoever is President in 5 years will have some energy options. He said that there are absolutely none for him now. He asked that the coal industry get busy and work on Congress to help push his energy program which consists of various conservation efforts plus the modification of the Clean Air Act and his version of the Strip Mine Reclamation Act. He also wants legislation to force conversion of existing boilers to coal and stop them from using oil or natural gas in utility boilers.

The net result of attending "Coal Day At The White House" is that my own personal picture of the nation's energy problems is considerably broader. President Ford impressed me very favorably, perhaps because I agree with many of the things he said. We really do need to lease and develop western coal to replace imported oil for the nation's economic stability and to give our

leaders some options in foreign policy. The national security aspect of dependence on foreign oil is so obvious that I don't understand why Congress appears to pay homage to the environmental movement and delay coal development.

Here at the Fort Union Coal Field Symposium I see there are many of the same speakers that have been to other coal meetings in Montana. The attitudes of some of these people have changed, others have not swayed in their ideas with regard to coal development. I am convinced that western coal should be mined. I am also convinced that reclamation is possible and is being done on a day to day basis and I am certain in my own heart that it is the right thing to do. I hope I can come to some future coal meeting and answer the question, "Are They Still Mining Coal?" with an emphatic "YES".

* * *

Fort Union Coal Field Symposium

ENERGY, THE ECONOMY AND THE DECISION PROCESS

Thomas C. Kryzer*

Whether discussing a new coal mine -- a new electric generating plant -- coal gasification -- or the conversion of lignite into fertilizer so desperately needed by our agricultural industry -- there are underlying economic factors that must be recognized. An understanding of these economic variables and the basic need for energy will provide the vital ingredients for developing rational policies and decisions. Of necessity, the problem must be viewed more broadly than local, state, or regional boundaries will permit.

In order to bring this need for energy into proper perspective, it is absolutely essential that policies and decisions recognize the time frame in which they are dealing. While we must rightfully set long-term goals, we must at the same time satisfy our short-term needs.

Regardless of which energy scenario this nations sets as its long-term objective, the ability to reach that goal will depend on how we choose to supply our short-term energy demand.

The economic health of the United States over the short term will provide the financial lifeblood necessary to reach our long-term objectives. All too often, we tend to confuse our interests and desires for tomorrow with the stark realities of today.

In the energy industry the divison between the short and long-term planning horizons, when major changes can occur, may be 25 years or more. We we think of the forced wartime research and development under which the atom was harnessed and how long the promise of nuclear power has been with us, it still only supplies a little over 1 percent of our energy demand.

The relationship between energy and the economy makes it absolutely essential to our national best interest that this delicate balance be reflected in energy-related laws, policies, and decisions in the months and years ahead if we are to avoid massive unemployment.

The roots of today's economic and energy problems go deep into the energy policies and decisions of the past. We are today witnessing the trauma that results (at the local, national, and international levels) when this balance is upset. Policies and decisions which ignore this apparent coupling between economic variables and energy consumption could produce disastrous results as we have already observed.

The Arab oil embargo finally brought into sharp focus the energy crisis that had been building for decades. Causal relationships are complex and have world-wide implications. Therefore, long-range solutions cut across local, state, regional, and national boundaries. For this reason, now more than at any other

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time in our history, we need rational decision-making at all levels in both the public and private sectors.

It is clear the United States must alter its energy supply/demand mix with due regard for social, economic, and environmental considerations. Obviously, there have to be trade-offs since there is no perfect answer to such a complex problem, but the mistake must not be made of overemphasis on one while disregarding all others, which stems from viewing each situation as independent and unrelated to the much larger issue. However, if these trade-offs are not properly evaluated, there will be little understanding of what we are getting, what we are giving up, and the price we are asked to pay. As a result, there will be overreaction, laws passed, and rules promulgated without adequate homework having been done to insure that what is required is reasonable and proper and in the nation's long-term best interest.

We cannot develop -- or grow -- or even stay where we are without energy supplies in a wide variety of forms. Therefore, denied a sufficient supply of energy, any developed country would progressively revert to a primitive state.

There is need for reasonable growth, and we must find ways to reconcile supplying this need while protecting the environment, since protection of the environment is a commanding consideration in virtually all the plans we make in the public and private sectors.

However, the search for a better quality of life must not start and stop with environmental protection -- as important as this is -- but also must include economic stability, the capacity of the poor to escape poverty, the maintenance of personal independence and pride, the availability of employment, the capacity to buy and own material things, the ability to pay for and enjoy a clean environment, and the fiscal viability of governmental units.

Now let's look at some of the specifics:

In the fall of 1973, petroleum liquids were being produced in the U.S. at the rate of 10.8 million barrels per day -- in the fall of 1974, the rate of production had declined to 10.3 million barrels per day -- down 5 percent.

In the summer of 1973, U. S. miners were producing coal at a rate of about 580 million tons annually -- in the summer of 1974, the rate of coal production in this country was still about 580 million tons -- no change.

In the fall of 1973, natural gas was being produced domestically at a rate of 22 trillion cubic feet per year -- a year later, the production rate was about one trillion cubic feet per year less -- down 5 percent.

In 1973, the nuclear power generated over 1 percent of the nation's energy -- in 1974, about 1-1/4 percent -- up 20 percent. But during 1974 more than half of the planned nuclear generating capacity additions were deferred and some canceled.

Excluding the period of the embargo, 1973 U. S. imports of crude oil and oil products averaged 5.8 million barrels per day -- again excluding the embargo period, the 1974 imports averaged 6.6 million barrels daily, increasing U. S. dependence on foreign energy -- up 14 percent.

The U. S. today is paying about $25 billion annually for foreign energy -- without prompt action, the cost of imports - assuming today's world oil prices in 1985 -- could rise as high as $52 billion per year.

The statistics tell the story. During the first year following the sudden cutoff of oil from the Middle East, little, if any, tangible progress was evident toward a lessening of our dependence on foreign energy. The U. S. is more vulnerable to an embargo today than it was in the fall of 1973.

Although Federal and State governments, industry, and the American people have undertaken some actions designed to conserve and to increase energy supplies, the sense of urgency aroused throughout the nation by the oil embargo has diminished with the lifting of the ban and a seemingly ample supply of gasoline.

There is a danger of being lulled into a sense of complacency because the current economic recession has reduced energy demand. Such a reduction in energy demand is to be expected to accompany a slowdown in the economy. Decisions must be made today and actions taken now to insure the nation's future economic growth with adequate supplies of domestic energy. To do otherwise invites disaster.

In the U. S. today, energy consumption patterns are totally out of phase with our energy reserve position. This is highlighted by the fact that, on a BTU basis, U. S. energy reserves are 96 percent in the form of coal versus only about 2 percent each for oil and natural gas. While at the same time, we supply only about 17 percent of our energy demand from coal, 5 percent from various sources -- such as nuclear, geothermal, and hydroelectric -- and about 78 percent from oil and natural gas.

To improve our energy position in the U. S., three basic strategies must be urgently pursued:

-- Energy conservation
-- Energy substitution
-- Energy production

Energy conservation, if it is to have a positive influence and not contribute to economic slowdown, must be concentrated in areas of efficiency and productivity improvement, along with decreasing waste. Therefore, conservation is the wise use of energy and not the prohibition of its use. Voluntary conservation efforts by an informed public have the advantage of increasing the rate of conservation without imposing serious dislocations or inequities on any one sector of the public. Government actions, primarily in the form of incentives, could assist voluntary conservation.

Energy substitution is very much related to conservation.

Scarce energy supplies, such as oil and gas, can be replaced in certain areas by our abundant domestic supplies of coal. Scarce fuels should be conserved for those uses in which substitution is not practical.

Caution must be taken in effecting reductions in energy demand. Historically, downturns in economic activity have been accompanied by downturns in energy consumption. The reduction in energy consumption caused by the supply curtailment during the recent embargo resulted in a significant downturn in GNP, along with related unemployment. Energy-savings at the expense of jobs is not the kind of demand reduction we should hold up as an example of which we can be proud.

This apparent link between primary energy consumption and real GNP will be difficult to break in the short run, and demand reduction actions should be undertaken which cause the least disruption to the economy. Over the long run, however, increases in energy prices, substantial applications of technology, capital investment, and changes in energy use practices may result in a reduction in energy consumption relative to real GNP.

The trends of energy consumption and GNP for the United States have been similar for many years through major business cycles and upsets due to wars and the great depression (Figure 1). The same is true on a per capita basis (Figure 2). There is also a correlation between total primary energy consumption and disposable personal income which indicates that regardless of employment level, energy prices, wartime or peacetime, boom, recession, or depression, when disposable personal income went up so did energy consumption; and when disposable personal income went down, down went energy consumption; as shown on Figure 3.

It is mathematically certain that the nation's labor force will continue to grow for many years to come. Certainly over the short term, if expansion of the Gross National Product were to be restrained by a lack of energy, the level of productive employment would not rise as fast as the labor force, as indicated in Figure 4. Conceivably, it might not rise at all, and unemployment with all its attendant problems could reach record proportions.

The inevitable economic, political and social impact of arbitrary restrictions of energy supply indicates emphasis should be placed on increasing the supply from stable domestic sources.

A major reduction in energy supply, which would result in an equally major reduction in goods and services, is not a wise policy for the United States. This, of course, does not rule out the incremental reductions that can and should be achieved through energy conservation at all levels of the economy. With the current need to change the nation's energy supply/demand mix, it is likely the energy-to-GNP ratio will increase, not decrease, in the foreseeable future.

The conclusion from available evidence indicates a much stronger effort must be made to maintain our primary energy supply proportional to our economic needs within the constraints of sound environmental policies. To place all of our hopes on the effectiveness of reducing demand in the face of the

Figure 1

HISTORIC TRENDS OF GNP AND ANNUAL ENERGY CONSUMPTION IN THE UNITED STATES

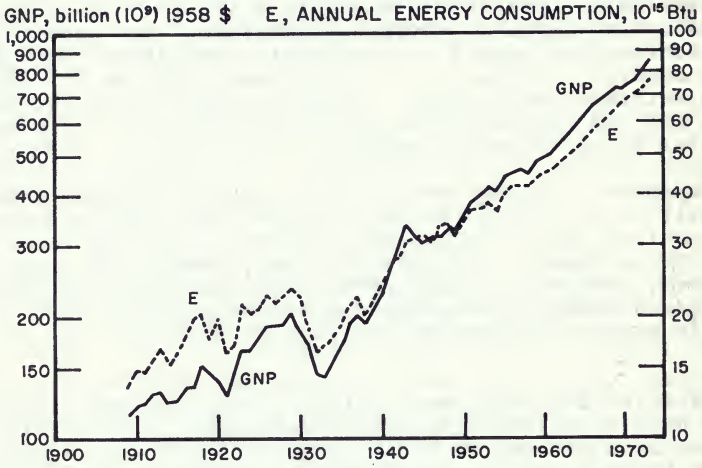


Figure 2

HISTORIC TRENDS OF PER CAPITA GNP, ANNUAL PER CAPITA ENERGY CONSUMPTION AND POPULATION OF THE UNITED STATES, 1909 – 1973

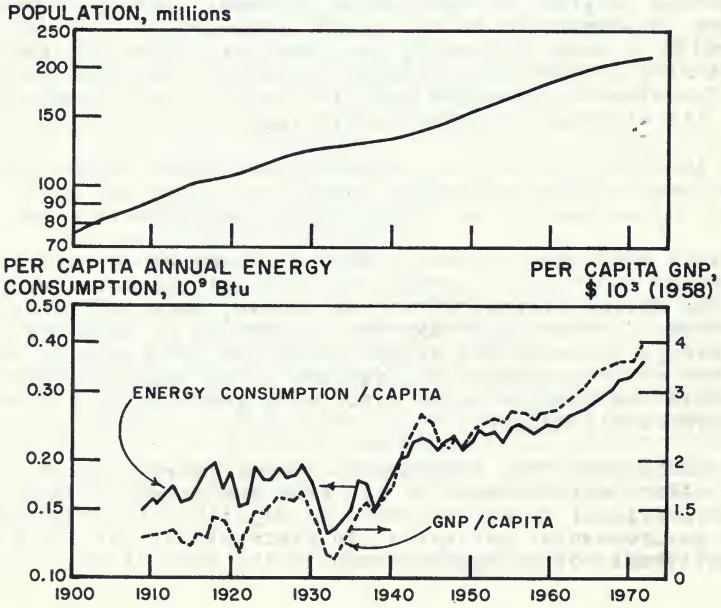


Figure 3

COMPARISON OF TRENDS OF PER CAPITA ENERGY CONSUMPTION AND PER CAPITA DISPOSABLE PERSONAL INCOME

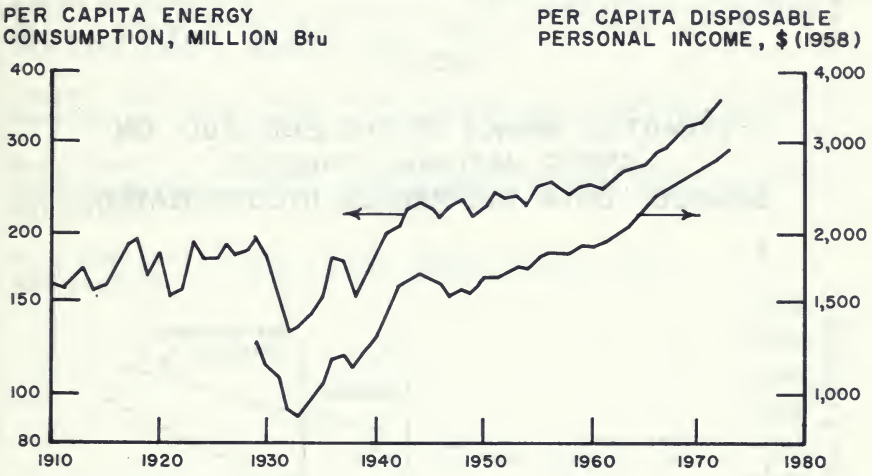
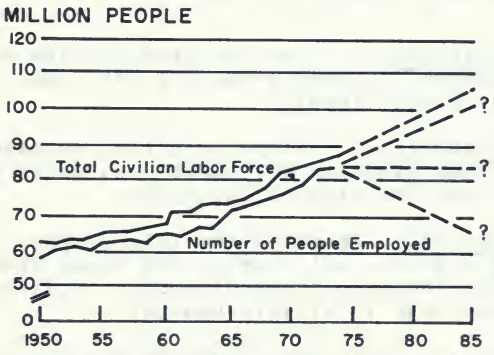


Figure 4

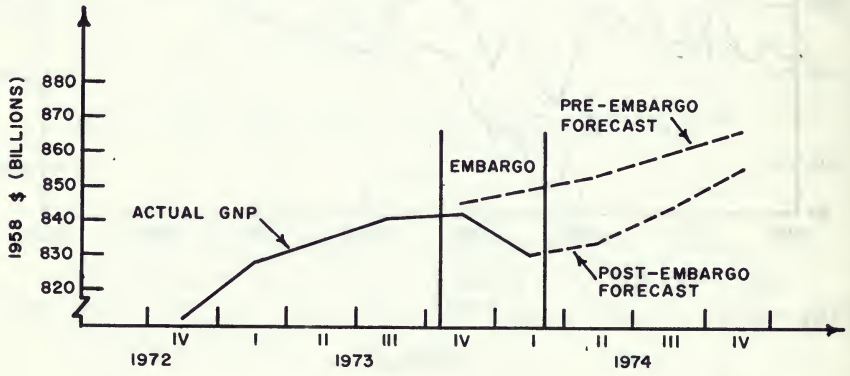
U.S. ENERGY SUPPLY WILL INFLUENCE GNP AND LEVEL OF EMPLOYMENT



discouraging historical data seems a very hazardous course. This has been dramatically illustrated by the economic upset which occurred as a result of the recent Arab oil embargo, causing a downturn in the GNP and an increase in unemployment, as shown in Figure 5. Therefore, as we bring about the transition in the U. S. energy supply/demand mix, we must maintain a very carefully balanced strategy of energy conservation, subsitution, and production. Developed and carried out properly, this transition can stimulate rather than depress the economy -- can be productive rather than counterproductive.

Figure 5

ESTIMATED IMPACT OF THE EMBARGO ON GROSS NATIONAL PRODUCT
SOURCE: DATA RESOURCES INCORPORATED



Burlington Northern's proposed Circle West Project for the production of nitrogen-based fertilizer from coal in an integrated agricultural-mineral-industrial development satisfies all three strategies.

Conservation: Raise the productivity of the agricultural industry, thereby producing more food and fiber with less total energy input.

Substitution: Release dwindling supplies of natural gas and other products for those uses where energy substitution is not practical or possible.

Production: Increase the total supply of energy by tapping a lignite coal reserve and bring this valuable resource into the mainstream of energy utilization which, up to now, has been relatively unused.

Additionally, Circle West could be the basis for establishing a fertilizer industry which would accrue to the economic benefit of the State and region.

If energy-related laws, policies, and decisions do not reflect the relationship between energy and the economy, we run the risk of serious economic upset and massive unemployment. One thing is clear -- a successful transition in the U.S. energy supply/demand mix cannot be accomplished overnight by adversaries acting in a polarized atmosphere or through simplistic self-serving solutions.

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DEVELOPMENTS AT WESTERN ENERGY COMPANY'S ROSEBUD MINE

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The history of the Rosebud mine at Colstrip can be traced back 51 years to 1924 when it was opened by the Northern Pacific Railway. In 34 years of mining, the railway company produced 44 million tons of coal to fuel its locomotives. In that period, Northern Pacific disturbed approximately 1,000 acres of ground, all of which is being reclaimed today by NP's successor company, Burlington Northern. The mine was shut down in 1958 when the railroad replaced its last steam locomotive with diesel power.

In 1959, Montana Power Company acquired the Northern Pacific's large mining machinery, the townsite of Colstrip and mining leases covering 75 million tons of proven coal reserves. Western Energy Company, coal mining subsidiary of Montana Power, later acquired additional coal leases in the area to increase its coal holdings to approximately 850 million tons of reserves at Colstrip.

In 1968, Western Energy Company reestablished mining production at Colstrip after a 10-year hiatus. The governing corporate philosophy in resuming the Colstrip mining operation involved two integral tenets: First, coal was to be produced economically for the purpose of supplying fuel to Montana Power's electric generating plant in Billings and to other customers; second, the mining operation had to be compatible with all legal and moral environmental obligations, including the reclamation of mined land.

In the same year that mining was resumed at Colstrip, 1968, Western Energy contracted with the Agricultural Experiment Station at Montana State University to conduct research with the objective of developing a comprehensive reclamation program that would result in restoration of mined land to its pre-mining use or to a higher use.(18) The reclamation program was initiated before the State of Montana had compulsory reclamation laws. By the time the Montana Strip Mine and Reclamation Act of 1973 was passed by the Legislature, the Colstrip reclamation program had been developed to the point where it substantially complied with the provisions of the law.(7, 8, 9, 13, 15)

Reclamation proceeded concurrent with mining. Coal production figures were as follows: 1968, 150,000 tons; 1969, 521,000 tons; 1970, 1,658,000 tons; 1971, 5,161,000 tons; 1972, 5,501,000 tons; 1973, 4,254,000; and 1974, 3,212,000. The lower figures for 1973 and 1974 reflect an interim period during which short-term coal contracts were expiring and production under new long-term contracts had not yet commenced.

Production in 1975 is scheduled to reach 6.8 million tons. The coal will be shipped by unit train to utility customers in Illinois, Wisconsin, and Minnesota, to small industrial customers in the Midwest and to Montana Power's coal-fired generating plant in Billings. This year also will mark the beginning of a pro-

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duction for the first 350,000-kilowatt electric generating unit being constructed at Colstrip by Montana Power and Puget Sound Power and Light Company. As utility customers complete additional generating units to be supplied under long-term coal contracts, coal production will continue to increase. Projected production for 1976 is 10.3 million tons; for 1977, 13.0 million tons; for 1978, 13.2 million tons; for 1979, 14.6 million tons; and for 1980, 17.4 million tons. The latter figure assumes two coal-fired, 700,000-kilowatt generating units will be constructed at Colstrip in addition to the two 350,000 kilowatt units already being built there.

The process of preparing for a larger mining operation involved meticulous planning. Acquisition of equipment and facilities required large expenditures of capital and extensive lead time. Provision of a human habitat that would ensure desirable living conditions was considered a requisite to a successful operation. Compliance with provisions of law governing surface mining necessitated detailed and acceptable planning before final permission to mine could be granted.

Community planning was conducted by the Ken R. White Company, Denver, a nationally-recognized consulting firm. Based on extensive interviews with existing and future residents of Colstrip and a thorough assessment of the area's resources, a master plan for community growth was developed.(19) Architectural, engineering and landscaping firms then were engaged to execute the master plan. Concurrent with community development, the needs of the population have been reevaluated on a periodic basis. As the nature of the population has changed, the master plan has been revised to accommodate changing needs.(1)

Today, the Colstrip master plan is approaching total realization. In addition to modernization of 62 older homes at Colstrip, construction is proceeding on 226 homes and 60 multi-family living units. More than 160 permanent mobile home spaces complete the residential area. The commercial district plan includes a shopping center that is nearing completion, a bank that opened recently, a 20-unit motel that is operating and a service station. The shopping center contains space for a grocery store, pharmacy, hardware store, restaurant, post office, barber and beauty shops, laundromat, dry cleaners and medical and dental offices. Western Energy will not operate any of the businesses. Rather, building space is being leased to private businessmen.

The rationale behind Western Energy retaining control of the town lay in the desire to prevent the boom-town syndrome so often prevalent when a community experiences rapid, uncontrolled growth. At Colstrip, company ownership of the town has permitted thorough planning of all facets of the community, from water supply to sewer service, from the compatibility of housing architecture and colors to a complete system of parks and a network of pedestrain and bicycle paths.(14)

In response to needs expressed within the community, Western Energy and other companies operating in the mining operation or constructing the generating plant have cooperated to provide recreational facilities and opportunities.

A recreation program for both adults and young persons is organized and supervised by a fulltime recreational director. Space has been provided for a library and a recreation center is being constructed.

Close coordination with school authorities also has been a necessity. Prevention of crowded schools was accomplished this past school year by providing the school district with eight relocatable classrooms at a cost of $140,000 to the Colstrip project. The district will retain use of the classrooms without charge until a planned new school or school addition is completed.

Community expansion is costing about $10 million. When the program is complete, Colstrip population is expected to have increased from approximately 100 in 1968 to 1,800 or 2,000. Population stabilization also will be marked by the gradual realization of another goal, whose foundation has been laid in the last year. That is Western Energy's withdrawal from ownership of the town. Zoning, conveyance of property to private individuals and other steps to achieve orderly transition are requiring detailed planning.

Compared to roadblocks encountered in other activities, community development has been a relatively simple task in terms of necessary interface with government agencies. Laws and procedures affecting development largely are well established, and the goals of appropriate administering agencies generally have coincided with the objectives of the companies involved and the community.

The evolution of comprehensive, integrated mining and reclamation programs has been far more complicated. Continued development of the Rosebud mine has required intensive research encompassing a broad range of subject matter. The gathering and compilation of base-line data has required expertise in a multiplicity of disciplines. A simple recitation of studies initiated and conducted under the auspices of Western Energy Company or Montana Power Company pursuant to obtaining mining permits indicates the scope of required research and planning.

Since 1972, the Montana State University Agricultural Experiment Station has conducted a major range resource study in the Colstrip region. The research activity has involved the collection of physical and chemical information on soils, range vegetation and animals. This study has contributed to knowledge of areas to be mined as well as providing baseline data to permit future evaluation of the effects of generating plant stack emissions.(3, 11, 12)

The Earth Sciences Department at Montana State University this year will complete evaluation of trace elements in two strata of coal at the Rosebud mine.

Environmental Consulting Services is conducting a wildlife reconnaissance and vegetation survey over a 10-mile by 20-mile area to determine baseline conditions surrounding Colstrip.(2, 4)

The same area has been surveyed annually by air, employing infrared photography.

A three-year hydrology survey of future mining areas is being conducted by personnel from the Montana Bureau of Mines.(17)

Future mining areas also have been studied by the archaeologists from the Montana College of Mineral Sciences and Technology for archaeological evidence.(5, 6)

Reclamation research continues in its sixth year under the Montana State University Agricultural Experiment Station.(7, 10)

Additional studies are commissioned to provide other specific data required for mining permits.

The expenditure of literally hundreds of thousands of dollars in research accomplishes two principal purposes: First, it provides baseline data for future evaluations of the effects of coal development and of the effectiveness of measures taken to preserve the environment. Second, the collection of information and knowledge is employed in the preparation of mining permit applications.

The detailed research and planning for mining is complicated by the fact that they are accomplished under new laws and regulations whose imperfections have not been corrected and whose provisions still are subject to varying interpretations. At the same time substantial new coal development is being initiated, all parties affected by mining laws and regulations still are in the process of evaluating and defining the provisions of those laws and regulations.

For example, the mining permit system under the Montana Strip Mine and Reclamation Act has proved cumbersome both in terms of administration and compliance.(16) This difficulty apparently was not foreseen by the framers of the law. One of the contributing factors in making the law difficult to administer is the requirement for annual mining permits. Under the present system, the original mining permit must be renewed and another application must be submitted for the next year's operations. During the third year of operation, the previous two permits must be renewed and a third permit must be submitted for the next year. It is conceivable that 25 separate permits and renewals would be required for a single mining area. Obviously, such duplication could be eliminated without sacrificing the law's environmental criteria or its effectiveness.

The difficulties in adjusting to new laws are just part of the problem. Perhaps the most troubling situation to many mine operators has been the lack of any definite policies by the federal government concerning leasing of federally-owned coal rights and the absence of any decision on the federal surface mining law. The federal government's dominant ownership of western coal precludes extensive development until leasing decisions are made.

Despite the fact that federal coal rights do not compose a majority of Western Energy Company's holdings, they are sufficiently substantial to constitute a hindrance to efficient and orderly mining. At Colstrip, Western Energy Company currently controls 26,287 acres of coal lands, of which 7,173 acres or approximately 30 per cent, are U.S. coal leases. In addition, we filed in 1972 an application for 6,082 acres of federal coal

leases interspersed within that area. Three years later those leases have yet to be granted.

Withholding of federal leases impedes development for the following reasons: First, without knowledge that the coal will be available, it is not feasible to assure utilities and other potential customers that coal can be furnished to meet their needs. Second, because federal coal leases tend to be situated in a checkerboard pattern in many areas of the west, the logistics of an efficient mining plan can be vastly complicated. Third, under certain circumstances withholding of federal coal land may render uneconomic an otherwise viable coal mining area. Fourth, potential unavailability of federal coal can delay the large investment required before a new mine can be opened. With increasing lead times for delivery of new equipment in the industry, delays in investment will result in additional delays in mining.

Generally speaking, the difficulty in coping with changing laws and shifting interpretations of laws is not a subject justifying excoriation of government personnel and agencies. Nevertheless, it is a problem that demands recognition and expeditious resolution. Certainly, in view of the need for western coal and western coal's potential for alleviation of national and state energy shortages, as a society we will be wise to clarify and simplify our intent with respect to western coal. The numerous changes that could contribute to more efficient mining---without environmental sacrificies---would benefit both mine operators and the individual who, ultimately, pays for inefficiency and indecision: namely, the consumer.

At the Rosebud mine, we deal on a daily basis with the complicated sets of circumstances that have been cited, as well as many others. Areas of uncertainty and frustration remain, but we have successfully adjusted to changing requirements established in laws and regulations. Western Energy Company today is investing $40 million in capital equipment. Another $10 million is being invested in the town of Colstrip. And hundreds of thousands of dollars are being spent in research that contributes to optimum environmental conditions in the Colstrip region.

In brief, developments at the Rosebud mine are preceded by the numerous, substantive pre-development activities made necessary by the desire to conduct mining in an exemplary manner and by legal requirements having the same basic objective.

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ADEQUACY OF THE COAL RESOURCE DATA, FORT UNION REGION, EASTERN MONTANA

Robert E. Matson*

It is a pleasure to have been invited to participate on this panel with such an array of distinguished members, many of whom I have known and associated with for a number of years. It is perhaps appropriate to be on a panel on administration since more and more time and effort is now required for this purpose. From my experience in the Energy Division of the Montana Bureau of Mines and Geology my definition of administration would be the necessary tasks which need to be done before productive work can be accomplished.

When we started in the business of looking at the coal resources in the Fort Union Region of eastern Montana things were accomplished in an almost casual way. In order to permit a drill hole we simply went to the surface owner or lessee and asked for permission. In most cases all we needed to do was explain our intentions and assure the rancher that we were not siesmographers and would let him know if we found any ground water. Things have changed somewhat we now have to start planning months in advance and carefully preselect a drill site, scout it out, secure the surface owners written permission, file a written application in duplicate with the State Land Commissioners office, wait for review of the application, conduct a tour for the representative from the Commissioners office, obtain a bond, and wait for approval. Once we have gone through this exercise we are then in a position to start at the point we used to start at. We then do the drilling after which we reclaim the drill site area and hope the bond will be released upon proof of satisfactory reclamation at some date in the future.

This is an exercise which makes one dream up ways of becoming more efficient or just plain adding more hands. At least the Montana reclamation law is universal in that it regulates representation of the state as well as private industry.

We have been accused during the past two years of moving our coal resource evaluation work to Wyoming because of the severe restrictions placed on exploration by the Montana Reclamation Law. I can assure you that this isn't true. The reason was money--federal money.

The availability of federal money wasn't anything new but it came at a time when it was badly needed or at the close of the State Environmental Protection Agency joint resource project which resulted in MBMG Bulletin 91 titled, "Quality and Reserves of Strippable Coal, Selected Deposits, Southeastern Montana". During the period of this project, the $500,000 (plus) budget was almost equally shared by the state and the EPA. Following its completion, the state funds, particularly for operations, became almost nil.

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This may have been due to a change of attitude in the state. When we initiated our work in coal resources research our goal was to promote the development of this dormant abundant resource for the economic benefit of the state.

All I can say, after seeing the new severance tax levy, is that we have obviously succeeded beyond our wildest dreams.

It may be necessary at this point to digress and discuss why we are doing work in coal in the first place. To put everything in proper perspective, the Montana Bureau of Mines and Geology is a department of the Montana College of Mineral Science and Technology and therefore, as a department, the President of the College is theoretically the head of the Bureau. As a department of the College most of the Bureau staff have academic rank and can function through the Montana Tech Research Foundation which accepts and administors non-state appropriated funds. The Bureau has additional legislative mandates which include evaluating the states mineral and coal resources to promote the development of these resources.

Following the 4 1/2 year EPA-state coal project, the U.S. Geological Survey Mineral Classification Branch became our benefactor and allowed us to proceed in our accustomed ways to assist in the further evaluation of the coal resources of Montana, the Wyoming portion of the Powder River Basin, and a small portion of North Dakota. We are now about to begin our fourth year of work under grants from the U.S. Geological Survey. During 1972 and 1973 the grants were $60,000 each year, in 1974 the grant was $75,000 and in 1975 it will be around $100,000. A small amount of state funds has been matched in the form of salaries each year when work has been carried out in Montana.

The work under grant from the U.S. Geological Survey is coordinated to survey surface mapping of 7 1/2 minute quadrangles. Areas covered to date include the Decker and Pearl School quadrangles in southeastern Montana, and the Twin Buttes School and Morehouse School quads northeast of Miles City. In Wyoming we have worked in the Sheridan and Gillette areas and in North Dakota, north of Beulah. Our product appears in the form of joint USGS-Bureau open-file reports containing the drilling information in lithologic logs, geophysical logs, and analytical reports of coal core samples obtained. Proximate analysis, Btu values, sulfur and sulfur forms are obtained in the MBMG analytical lab and splits of samples are sent to the USGS Denver analytical labs for trace element analyses.

Working in Wyoming in the Wyodak (Anderson) seam makes Montanas knowledgable in coal deposits set up and take notice. Of the five new mines on the Gillette area under development, four including Wyodak, Ken McGee, Atlantic Richfield, and Sun are in coal seams about 70 feet thick (79,296,000 tons per section) and one, the Carter Mine, has coal in excess of 100 feet thick (113, 280,000 tons per section). In Montana, for comparison, our thickest published figure is 87 feet for a single coal bed and that is in the Decker area. In reality the proposed Gillette area mines as well as Belle Ayre are best described as strip operations and not requiring large draglines in the initial stages of mine development. From the plans presented in environ-

mental impact statement it appears the greatest permanent impact from these proposed strip mines will be in the crushing, storing, loading and maintenance facilities.

The Wyodak probably comes closest to the surface coal miner's dream--thick coal with very little overburden. Looking for such deposits was our goal when we first began our program of evaluation of strippable coal areas in Montana. We attempted to pick the most economically fiasible strippable coal deposits. As we progressed on our EPA-state coal project we began looking at higher overburden ratios, steeper slopes, multi-seams, and thinner coal beds.

Originally, we set out to evaluate all of the Fort Union Region in Montana and we fell far short of that goal. We did manage to complete most of the area south of the Yellowstone except for the Northern Cheyenne and Crow Reservation areas, the Sarpy Creek area and some much smaller less important areas. With the help of information compiled from previous investigations, several by Burlington Northern Inc., Bulletin 91 gives a good approximation of the strippable coal reserves. Data points and core samples are generally sufficient to allow correlation of the coal beds and determination of the generalized structure of each coal field as well as measure the average coal thickness and determine coal quantity. Our intent was to core each coal bed, where feasible, in each drill hole and at the end of the project we ended up with 284 drill holes and 3,272 feet of core.

Completion of Bulletin 91 gave us a basis for compiling a new estimate of Montana's strippable coal reserves, one which is better than the previous one but still far from complete.

We know the 42.5 million ton coal reserve figures can be greatly improved upon when more data are obtained. Very little information, for example, is publically available on the Northern Cheyenne or Crow Indian Reservations. We estimated reserves on some of the strippable coal deposits on the Reservation areas by projecting our data from adjacent or nearby areas to base blocks, but we know our figures are very conservative. There are large areas where strippable coal occurs but we have practically no information on the limits of the deposits except what can be inferred a few from geophysical logs of isolated oil well test holes. Private company data on prospective permit areas have not been available to us.

Other important areas where we have practically no information on the coal is in the Burn's Creek-Thirteen Mile Creek area in Dawson and Richland Counties, the southwest Glendive deposit (which we do not have on our strippable coal area map) which probably has reserves in excess of one-half billion tons, and the entire area north of the Missouri in northeast Montana except for those mapped by the Great Northern Railway Company (now the Burlington Northern). In some areas such as the Wibaux-Beach deposit and McCone County a limited amount of information is available but it is not adequate to properly assess the coal resources.

Plans are now underway, however, to do additional field work in some of these areas under our grant from the U.S. Geolo-

gical Survey. The federally owned coal lands of Dreyer Ranch Inc. area of Western McCone County will be evaluated this year in preparation for a future competitive lease sale. Field exploration in adjoining Dawson and Richland Counties is also being planned in the Thirteen Mile Creek-Burns Creek area and in the Gerrard coal field north of Sidney. With the planned continuation of the coal resource program we can anticipate that within three more years we should have a good approximation of the actual strippable coal resources throughout the Fort Union Region of eastern Montana. That is the necessary basic data needed will be available to allow correlation of coal beds, interpretation of the structure, and determination of coal thickness and quality.

However, this basic data no longer is adequate. Environmental impact analyses and statements require, before development, a much greater assortment of data including trace element analyses of the coal, overburden material, and ground water quantity and quality. Because of these needs our operation has become more complex. We are cooperating with the U.S. Geological Survey Hydrologic Division and will complete observation wells at selected drill locations for hydrologic monitoring.

The need for detailed data in future areas to be mined means we need to return to previously evaluated coal field and obtain additional information. We have been asked by the U. S. Geological Survey to submit a proposal to do this starting this year. In an initial phase of this project we are gathering 30 channel samples from our active mining areas which will be submitted to the U.S. Geological Survey in Denver for trace element analyses. The second phase will include gathering materials in areas projected to be mined within the next 10 years.

Another area of possible future activity is in the evaluation of the value of coal on state lands. In the past we have advised the office of the State Land Commissioner previous to competitive lease sales of the potential value of coal on state lands. In our report we attempted to evaluate strippable coal on a particular state tract from available published information. It is now contemplated that future evaluations will include drilling and coring.

The informational needs and increasing administrative complexity assure our activities in coal resource evaluation for a long time to come. Also as greater amounts of data are accumulated better means of storage and retrieval of this data are necessary. Here again the U.S. Geological Survey has taken the initiative. In a meeting in January at Reston, Virginia, with state representatives from most of the coal producing states, the survey explained its data system and asked the states to begin key-punching the reliable coal data they possess. We have not started this as yet although the Bureau now has a computer division which has been funded by contributions from federal agencies for this purpose. Preparation of the coal data for computer application will place a greater burden on our limited staff in the Energy Division of the Bureau but hopefully the returns will be worth it.

About 2 years ago when we had almost finished the EPA-state coal evaluation project someone asked me what we in the Energy

Division were going to do next since we had completed the coal work. My answer was that as the coal becomes of even greater economic interest there will be a need for the expansion of our work in coal. This prediction has proven to be true.

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CONSERVATION DIVISION'S ROLE IN COAL ENERGY DEVELOPMENT, FORT UNION AREA

Russell G. Wayland*

INTRODUCTION

In the States of Montana, North Dakota, and Wyoming, and wherever coal is owned by the Federal Government or by Indians, regardless of surface ownership, the Conservation Division provides a scientific, technical and management service to the Bureau of Land Management and, to a lesser degree, to the Bureau of Indian Affairs. This service includes geologic, engineering, and economic value determinations needed for mineral leasing; determination of the mineral characteristics of lease and permit areas; determination of the amounts of bonds, of royalties, and of reserves via pre-sale and post-sale valuations of tracts to be offered for competitive lease by the Bureau of Land Management; and the monitoring of development and production by lessees and the collection of royalties based on the value of production. In recent years the supervision of mining operations by the Mining Supervisors of the Geological Survey is increasingly being directed to reclamation of mined land. The Geological Survey exercises the Secretary-delegated authority concerning work conducted within the area of operations by permittees and lessees and authorizes the actions to be taken by them from the standpoint of development, conservation, and management of leasable mineral resources under the jurisdiction of the Department of the Interior.

STRUCTURE AND FUNCTION

Organization

The Conservation Division is one of four operating Divisions of the Geological Survey and is the only Division of the Survey which has regulatory functions. Its current strength is approximately 920 people, largely technical. It is the largest employer of petroleum engineers in the Federal Government, and the staff also includes geologists, mining engineers, accountants, and other disciplines. In the States of Montana, North Dakota, and Wyoming, the Division has the Offices of the Area Mining Supervisor, a District Geologist, and a District Oil and Gas Supervisor in Billings; an Area Oil and Gas Supervisor and an Area Geologist in Casper; four District Oil and Gas Supervisor offices elsewhere in Wyoming; and a District Mining Supervisor in Rock Springs. The southeastern portion of the Wyoming coal areas is handled from the Office of the Area Mining Supervisor in Denver.

Objectives

In support of the Department's mineral management objectives of orderly and timely resource development, protection of the environment, and receipt of fair market value for leased mineral resources, the Conservation Division, through its Mining Supervisors

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is concerned with the exploration, development and production of coal in a manner compatible with the long-term use of the same land for other purposes, and in encouraging the maximum ultimate recovery of coal, preventing waste, and promoting conservation. The Division encourages diligent development and assures a fair market value return to the public or Indian owner of the produced coal.

Relations to other organizations

Within the Geological Survey, the Conservation Division's personnel benefit directly from a close association with the scientific and technical experts of the Geologic Division and the Water Resources Division and, to a lesser extent, the Topographic Division, and the newly formed Office of Land Information and Analysis. Externally the Division personnel work very closely with the Bureau of Land Management and, to a lesser extent, with the Bureau of Indian Affairs, the Forest Service, Naval Petroleum Reserve personnel, the Bureau of Mines, the Mine Enforcement and Safety Administration, and, on occasion, with other Federal organizations to whom the Division provides management services or technical advice in its area of competence. The principal statutory and regulatory authorities for the Division's operations in the Fort Union Area are to be found in the Mineral Leasing Act of 1920, the Secretary's mineral leasing and operating regulations, the Secretary's surface mining regulations, and Secretarial Order 2948. The Division's role under these laws and regulations can, in general, be divided into pre-lease roles and post-lease roles.

ROLES OF THE CONSERVATION DIVISION

Pre-lease roles

Although the Bureau of Land Management has been delegated the Secretary's discretionary authority to determine whether or not to issue leases or permits for federally-owned coal and is the office of record in mineral leasing matters, the Geological Survey's Conservation Division receives copies of all applications for all such permits or leases from the Bureau of Land Management. One purpose of this is for the Division to determine if sufficient information is known about the coal deposits in the land under application to warrant offering the deposits for lease by competitive sale. If information is insufficient, the Survey so advises the Bureau of Land Management, which may then issue a prospecting permit. The Conservation Division establishes the prospecting requirements for any permits issued, and where a permittee has drilled land, the Division determines if the permittee has demonstrated the existence of coal in commercial quantities. The Division then certifies to the Bureau of Land Management that the permittee is or is not qualified for issuance of a preference right lease. It also determines, with respect to land to be competitively or noncompetitively leased, what the royalty, rental, bonding, and reserves and tract values are to be, and recommends other terms and conditions pertaining to lease operations, including environmental and surface rehabilitation stipulations, to be included in a lease.

When the Bureau of Land Management conducts a competitive coal lease sale, Geological Survey's resource evaluations are

used and the Survey generally has a representative at the sale to render a post-sale recommendation to BLM regarding acceptance or rejection of the bids. The two Bureaus exchange files and records, including copies of permits and leases and relevant correspondence, copies of mining and exploration and rehabilitation plans, and relevant items submitted by applicants directly to the Geological Survey. An exception is confidential proprietary information, which may be seen by authorized Bureau of Land Management personnel but is in general retained in Survey offices for protection.

In recent years, with few coal leases and no permits being issued by the Bureau of Land Management, the Conservation Division's pre-lease activities in the tri-state area are concentrated on collecting and compiling available data on coal resources and the generation of new data through our own mapping and drilling programs to expand our knowledge of the coal resource base. In particular, we have devoted our efforts in the first instance to the establishment and delineation of known coal leasing areas (KCLA's). These determine where Federal coal will be leased competitively and are based on compilation of all available published and unpublished data, including company confidential data, data from oil and gas well logs, and our own mapping and drilling efforts. This work has resulted in the delineation of 17 KCLA's totaling 9.4 million acres during the period from September 1973 through March 1975. Of these, 10 KCLA's totaling 7.7 million acres are in the Montana-North Dakota-Wyoming area. Twelve more KCLA's are currently being defined, including three in North Dakota and Wyoming.

As a second phase of this work, we are now also preparing leasable mineral resource occurrence maps within the known coal leasing areas. These maps include not only outcrop and quality and thickness measurements, but location of bore holes and projected sub-surface extent. A narrative to accompany these maps will provide details as to the quality, thickness, depth, and extent and other pertinent information required by or useful to the Bureau of Land Management. These maps also help us provide the basis for establishment of logical leasing and mining units by the Mining Supervisors of the Division, or review of industry proposals, and provide improved data for the establishment of minimum acceptable bonus bids and advance royalties. Supporting data compiled in the preparation of these maps include cross-sections, isobath maps, overburden maps, structure maps, block diagrams, and other such illustrations as are appropriate to the area. Normally these maps and the report incorporate much company confidential data and are therefore unpublished and restricted to confidential usage; derivative maps may be publishable.

The third phase of this presale work, also largely for the Bureau of Land Management, is to prepare overlays of potential development maps distinguishing high, moderate, and low development coal potentials and areas of probable surface disturbance. This is of use for BLM land planning, environmental analysis, or impact statements. Ordinarily a general reserve estimate is furnished the BLM at this time, particularly of strippable reserves.

As funds and time permit, we have a program to expand and establish more KCLA's and delineate new leasing areas through

further mapping, drilling, or acquisition of new data from other sources. Byproducts of these activities can include some publishing of coal maps and reports which collectively can add significantly to the overall data base of Fort Union coal deposits. All such Survey-generated data is made public as timely as possible in open-file releases and various publications.

The Conservation Division currently has a staff of 14 geologists working exclusively on coal evaluation in the Fort Union area. Seven of these professionals are headquartered in Casper, and the remaining seven are headquartered in Billings. An additional five geologists are expected to be assigned within the next few months, three in Casper and two in Billings. In addition to the Powder River Basin, six areas in Montana and eleven areas in North Dakota are currently under investigation by Division personnel.

In the past the tract selection and tract evaluation service for competitive sales provided to BLM has largely been based on general resource knowledge and on comparative values from sales of like coal land. Recently we have begun to use discounted cash flow analysis methods for evaluation of lease tracts in coal lands, adapting techniques developed in our evaluation of Outer Continental Shelf oil and gas lands and geothermal properties.

Because of our current concentration on lands known to contain commercial quantities of coal and therefore susceptible to competitive leasing, our long-standing responsibility for classifying lands of potential value for coal in order to retain mineral rights to the Government when surface rights are transferred or alienated has had to be deferred, except on a caseload rather than a systematic approach. We have also diverted our Division geologists from advisory services to the BLM on locatable and common variety minerals, and on Indian lands our Division geologists are restricted to working only with engineers on lease management problems. All Survey assistance to the surface management bureaus on locatable minerals and on Indian land resource appraisals is now provided by the Geologic Divison of the Geological Survey.

Pre-lease joint inspections

The Secretary's regulations, Title 43 CFR, Part 23, and Title 25 CFR, Part 177, provide for joint inspections by the surface management agency and the Geological Survey, particularly with respect to surface mining operations. In the Fort Union coal area, any area under application for a competitive lease or prospecting permit for coal will be visited by a team consisting of the various specialists on the technical staff of the Bureau of Land Management plus a Geological Survey mining supervisor. The purpose is to determine what stipulations should be included in the lease or permit for surface protection prior to the issuance of the lease or permit. Normally the applicant is in the inspection group.

Where the Bureau of Land Management determines as a result of its environmental impact analysis that granting an application for a permit will constitute a major Federal action significantly affecting the quality of the human environment, the Geological Survey must assist in the preparation of the environmental impact statement. Due to the temporary leasing moratorium for coal, this

activity has been limited to assisting with the coal programmatic environmental impact statement. If in the near future the Secretary establishes a new coal leasing policy, it can be expected that such a statement will apply on a regional basis to a number of areas under application for preference right leases or under consideration for new competitive leasing.

Post-lease roles of the Conservation Division

The lease management role of the Conservation Division of the Geological Survey dates back only 55 years, in contrast to its classification role which dates back to 1879. Management personnel at first were located in the Bureau of Mines. Then in 1925 they were transferred from there to the Geological Survey, and the Conservation Division (then a Branch) was formed to combine the classification and management roles. The original coal operating regulations, Title 30 CFR, Part 211, have been the principal authority for the functions of the mining supervisors of the Division over the years. These regulations which are still in effect, although revisions are proposed, bestow relatively broad authority on the Division's mining supervisors without providing complete and specific guidance to the supervisors. Through the years the principal guidelines to the supervisors have been certain key phrases in the Mineral Leasing Act itself calling for best practices, prevention of damage, prevention of waste, and protection of correlative rights and, in a subsequent amendment, a charge to maximize recovery. In overseeing the work of the mining supervisors during the 55 years, the Directors of the Survey and the Chiefs of the Division have consistently required that the mining supervisors see to it that lessee operations under their supervision have exemplified the best practices of the day. This does not mean that the best practices acceptable to the Director, and to the public, in 1935 would be acceptable today. Applications filed by the lessees to conduct operations have been subjected to increasingly detailed review and attention to considerations such as environmental effects, even before there was a National Environmental Policy Act.

In order to assist the industry in their understanding of what they should expect to be required by a mining supervisor to do in their lease operations, revisions and modernizing of the mining operating regulations have been under study within the Division and under review throughout the Department off and on for the last ten years. A few years ago the revision on the non-coal mining regulations, 30 CFR 231, was completed. The proposed coal operating regulations have since then twice been published in the Federal Register for public review most recently on January 30 of this year. This proposed revision deliberately follows closely the performance standards contained in the bill passed by the 93rd Congress for the reclamation of mined areas throughout the United States. Among other things it makes it clear that reclamation work is to be performed as an integral part of mining operations and must be completed within reasonable time limits. Even under the existing regulations, the mining supervisor has had authority to require this, and increasingly in recent years has so required. Public response to the invitation to comment on the proposed regulations has been voluminous and helpful, and the Secretary will soon have the revised version before him for consideration as final rule making.

Under the new regulations, no operation can be conducted on a coal lease or permit except in accordance with an approved plan by the mining supervisor after appropriate consultation with the surface managing agency. An exploration plan must show the location and type of work to be conducted, the environmental protection procedures, access and support roads, and the reclamation procedures to be followed upon completion of exploratory operations. A mining plan must show the location, method of mining and extent, and all related activities necessary and incident to the proposed operations, including the necessary steps to be taken to protect the environment during operations and the reclamation methods to be used to restore and revegetate the disturbed areas. Mining plans are available for public inspection in the office of the mining supervisor. For new mining plans, for major modifications in existing surface mining plans, or for surface-related changes in existing underground mining plans submitted for approval, interested parties have a thirty-day period to inspect such plans and to comment. A notice of the availability of the plan is posted at the appropriate office of the district or area mining supervisor on the day the plan is received. A copy of the notice is mailed to the appropriate County Clerk for posting or publication. After considering all comments received, including those of the BLM or other surface managing agencies, the mining supervisor will approve or disapprove the plan or will indicate what modifications are necessary to conform to the provisions of the applicable regulations. Exploration and mining plans may be reasonably revised or supplemented by the mining supervisor at any time to adjust to changed conditions or to correct an oversight. If the operator seeks to obtain approval of a change or of a supplemental plan, he submits a written statement of the proposed change or supplement and a justification.

Once an exploration or mining plan is approved, the mining supervisor makes onsight inspections at least three times a year to assure compliance with the lease terms, the regulations, and the approved exploration or mining plans. A report is written following each inspection as to whether the operator is in compliance, and, if not, the supervisor's requirements for compliance are enumerated. The report is placed on file for public examination at the office of the mining supervisor except to the extent that it contains trade secrets of financial, commercial, geological, or geophysical information exempted under the Public Information Act.

Inspections of operations are also made by personnel of the Bureau of Land Management or the other surface managing agencies for operations being conducted within a defined area of operation. The surface managing agencies report their observations to the mining supervisor of the Geological Survey who takes necessary action. The supervisor usually discusses with the operator any violations observed and requires that they be corrected in a specified period of time. These violations are confirmed in writing to the company and are made a part of the public record on file at the office of the mining supervisor. If violations are not corrected in the specified time, the supervisor may suspend operations or request that BLM initiate action to cancel the lease or permit. During an inspection, the observations include attention to surface disturbance, to waste disposal, to overburden shaping to prevent soil erosion, to the amount and type of

revegetation, to the success of the revegetion, to verification of the amount of coal removed and its quality, to a check of production and sales records to assure that proper royalty is being received and that coal is not being wasted through improper practices. Current mine maps are required semi-annually. A report on the acreage disturbed and reclaimed is required also annually, as is an audit of the operator's financial records by a certified public accountant.

Both the Geological Survey and the surface management agency, usually BLM, make periodic inspections of the adequacy of control of surface run-off for its downstream sedimentation effects. If it is determined that sediment is being transported downstream, the supervisor will order additional siltation basins down drainage from the mine or the redesign of the existing siltation basins. Inspections also may include the collection of water samples for quality checks, the surveying of pits to check production, measurements of groundwater levels in monitoring wells, and the collection of spoil samples for a vegetative support test. Before a lease can be relinquished, all aspects of the regulations, laws, lease terms, and stipulations must be satisfied and all lands must be reclaimed and revegetated to reduce erosion, catch and hold water, and provide forage for livestock and other animals.

RELATION TO NEPA

Operating procedures developed to assure Survey compliance with the requirements of the National Environmental Policy Act (NEPA) include the preparation of an environmental impact analysis by the mining supervisor upon receipt of a mine development plan or an exploration plan. The anlaysis is prepared in consultation with the surface managing agencies and with appropriate state and local agencies. The plan is reviewed by the surface managing agency as well as by the Survey. A decision then must be made as to whether the approval of the plan as submitted or as modified by the supervisor constitutes a major Federal action significantly affecting the quality of the human environment, and thereby warranting a full environmental impact statement (EIS). The preliminary decision of the mining supervisor is reviewed by higher levels within the Division and, as necessary, above the Division by the Office of the Director or even by the Department before a decision is made. Where it is determined that an EIS required on a mining plan, the lead is usually assigned to the Geological Survey for the preparation of the statement and for the receipt of comments and recommendations from the Bureau of Land Management and other appropriate agencies. In any event, as provided by Secretarial Order 2948, the Survey will not approve an exploration or mining or reclamation plan if inconsistent with BLM's recommendations without further discussion and resolution of differences or, if necessary, the forwarding of the matter for decision to the Department.

An example of an EIS on a proposed coal mine development plan, prepared with the Conservation Division as the lead agency is the one on the Big Sky Mine in Montana. This statement was finalized in March of 1974. Another example is the draft EIS recently forwarded to the Council on Environmental Quality which covers the Belle Ayr South mine in the Gillette area. One now in preparation

covers the Young's Creek Mine on the Crow Reservation.

GROWTH OF INTEREST IN COAL LEASING

With the switch from a buyer's to a seller's market in coal in recent years, the public, Congressional, and Departmental interest in inactive coal leases has become quite penetrating. An action last December by the Department was to publish proposed changes to the coal leasing regulations dealing with the concepts of diligent production, continuous operations, and logical mining units. These heretofore undefined concepts are embodied in the Mineral Leasing Act but not specifically in the existing regulations. Prior to this, the Geological Survey had already systematically identified, in a preliminary way, 91 multiple-lease mining units and 129 single-lease mining units among the some 530 existing coal leases. Considering only Montana, North Dakota, and Wyoming, the acreage in each state currently under Federal coal lease is 36,000, 16,000, and 200,000 acres respectively. In the three states, 326 Federal leases have 75 mining units, including 23 multiple-lease mining units. The recoverable surface mineable reserves under lease in the three states total 9.5 billion tons. Our estimate of production, based on plans announced before the surface mining bill in Congress becomes law, is 21 million tons in 1975 and 82 million tons in 1980. This compares with 15 million tons produced in the three states from Federal leases in 1974. Under Indian lease in Montana are 91,000 acres in ten leases involving four mining units. The recoverable surface mineable reserves under Indian lease total 1.2 billion tons. Production was earlier projected at 4 million tons in 1975 and 16 million tons in 1980.

Bonuses paid for these leases total $8.5 million for the Federal leases and $1.5 million for the Indian leases. Recoverable reserves and leases committed to production in the three states, as far as we know now, are 3.0 billion tons of Federal coal and 80 million tons of Indian coal. Destinations are in Minnesota, Wisconsin, Michigan, Illinois, Indiana, South Dakota, Nebraska, Kansas, Oklahoma, Colorado, Texas, Arkansas, Iowa, and points east and south.

The official designation of logical mining units will be important for several reasons. Modern mines, both surface and underground, are designed to meet the long-term fuel requirements of specific customers. The analysis of the coal and the characteristics of the combustion process or gasification process are major factors in the design of plants. A single lease will seldom provide the needed tonnage of coal. The basic requisite for a logical mining unit is a compact area that can be developed in an efficient, economical, and orderly manner and that will result in the conservation of coal reserves and the proper rehabilitation of mined lands. In a given mine, the surface and coal ownerships may be Federal, Indian, State or private, all intermingled, but under the effective control of a single operator or a collective contract. A logical mining unit is like an oil and gas unit in that it gives the Secretary and the lessees greater flexibility in planning the development of leases to permit maximum recovery of coal with minimum impact on the environment. Many large mines now operating in the west have this in their future without an

official designation as a logical mining unit. The Bureau of Mines points out that 80 percent of all coal is now sold pursuant to long-term contracts which do not call for delivery for 10 to 15 years. A significant advantage to long-term reserves is that they minimize demand-supply lags and thus improve resource allocation and the ability to avoid fuel shortages. The Bureau points out that the period between the time a decision is made to build coal consuming plants and the time when coal deliveries are needed is at least ten years, and delivery commitments are necessary before construction begins. Finally the equipment manufacturers have a lead time of six to seven years for manufacturing major mining equipment.

CONCLUSION

In conclusion, it is the objective of the Conservation Division to administer the regulations and its assigned duties impartially in accordance with policy directives from the Secretary of the Interior and the Director of the Geological Survey. We do not advocate policy, and we do not place promotion of orderly and timely development above our other charges to prevent waste, prevent damage, protect the environment, maximize ultimate recovery, protect correlative rights, and return fair resource value. We value our credibility and our professional and scientific competence. We want to do the best possible job with our authorized budget and manpower as professional managers assigned to protect the public and Indian interests in the evaluation and management of their leasable mineral resources.

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Fort Union Coal Field Symposium

NEW ENERGY RESEARCH IN THE FISH AND WILDLIFE SERVICE

Robert E. Stewart, Jr.*

INTRODUCTION

It gives me great pleasure to be here today to discuss a new program within the Fish and Wildlife Service, a large part of which is oriented toward minimizing the ecological damage of energy development. I take this pleasure from several different points of view. First, we hope to involve other Federal agencies, State agencies, universities and private companies in this new program. Secondly, we intend to support both in-house and contract efforts as needed and hope to be able to obligate a considerable amount of our financial resources to that end. Thirdly, we wish to bring into the Fish and Wildlife Service the most talented people, people like yourselves, we can find from a wide variety of disciplines.

I wish to report today on the Biological Services Program activities in energy activities, particularly energy development in the Northern Great Plains. First, however, I would like to share with you an overview of the Biological Services Program, discuss our long- and short-term goals and objectives, financial and manpower resources, and specific elements of the Program. I will then dwell on where we are and where we are going with respect to energy related activities.

PROGRAM GOALS

The concept of our new program has been taking shape over the past few years. It was not until last fall, however, that the Fish and Wildlife Service began hiring personnel for Biological Services. Early this year the Washington Headquarters staff of Biological Services was completed. This new program is action oriented and it is interactive with other Fish and Wildlife Service programs, and other Federal and State energy efforts as well. The goals of the Biological Services Program are as follows:

1. Enhance the Fish and Wildlife Service's ecological capability with regard to fish and wildlife resources and their habitats, particularly in the area of environmental impact assessment.

2. Provide an analytical capability and information base to more effectively recognize and protect fish and wildlife values in land and water development decisions.

3. Facilitate more effective Fish and Wildlife Service participation in Departmental resource development programs and decisions.

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The long-term objectives of the program are as follows:

1. Support research, baseline studies, and planning directed toward selected environmental issues of critical importance to the Department of the Interior and the Fish and Wildlife Service.

2. Develop improved ecosystems information, baseline data, planning, and impact evaluation methods, and promote their utilization in the decision making process to information dissemination.

3. Assemble a critical mass of scientific and technical capabilities needed to provide improved ecological input to Departmental and other resource development programs.

STRUCTURE

Structurally, Biological Services answers to the Director, Fish and Wildlife Service, through the Associate Director for Environment and Research. Currently, it is divided into four program elements (Figure 1). These include: (a) Aquatic Ecosystems, (b) Upland Ecosystems, (c) Systems and Inventory, (d) Environmental Assistance.

Two of these program elements, the Aquatic Ecosystems and Upland Ecosystems, are designed to address and keep abreast of critical environmental issues. Within (a), the Aquatic Ecosystems element, there are four projects. These include: (1) Coastal Ecosystems and Water Resources Council Coastal Study, (2) Power Plant Siting, (3) Stream Alteration, and (4) Outer Continental Shelf projects. Under (b), the Upland Ecosystems element, there are also four projects. These include: (1) Western Water Allocation, (2) Oil Shale, (3) Coal, and (4) Geothermal projects.

BUDGET

The total base budget for the Biological Services program in fiscal year 1975 was $4.1 million. Of this total, $1.45 million was allocated to the Upland Ecosystems element of the program. This amounts to about 35 percent of the total budget. Our total expected base budget in fiscal year 1976 is $8.261 million, and of this amount a total of $3.620 million will be allocated to the Upland Ecosystems element. This constitutes about 44 percent of the total base budget. In addition to our base budget, we anticipate cooperative funding from other Federal agencies will amount to $3.2 million in fiscal year 1975 and $2.6 million in fiscal year 1976. If you have ideas or concepts of what must or should be done for wildlife in energy development we will appreciate your input. I do caution those who are interested to discuss these concepts with us before proposals are developed. We plan to identify problem areas and ask for specific proposals to meet defined needs.

STAFFING

We are committed in this program to developing an in-house ecological capability, par excellence. To meet this obligation we are assigned 110 positions in fiscal year 1975 and anticipate we will fill an additional 62 positions in fiscal year 1976.

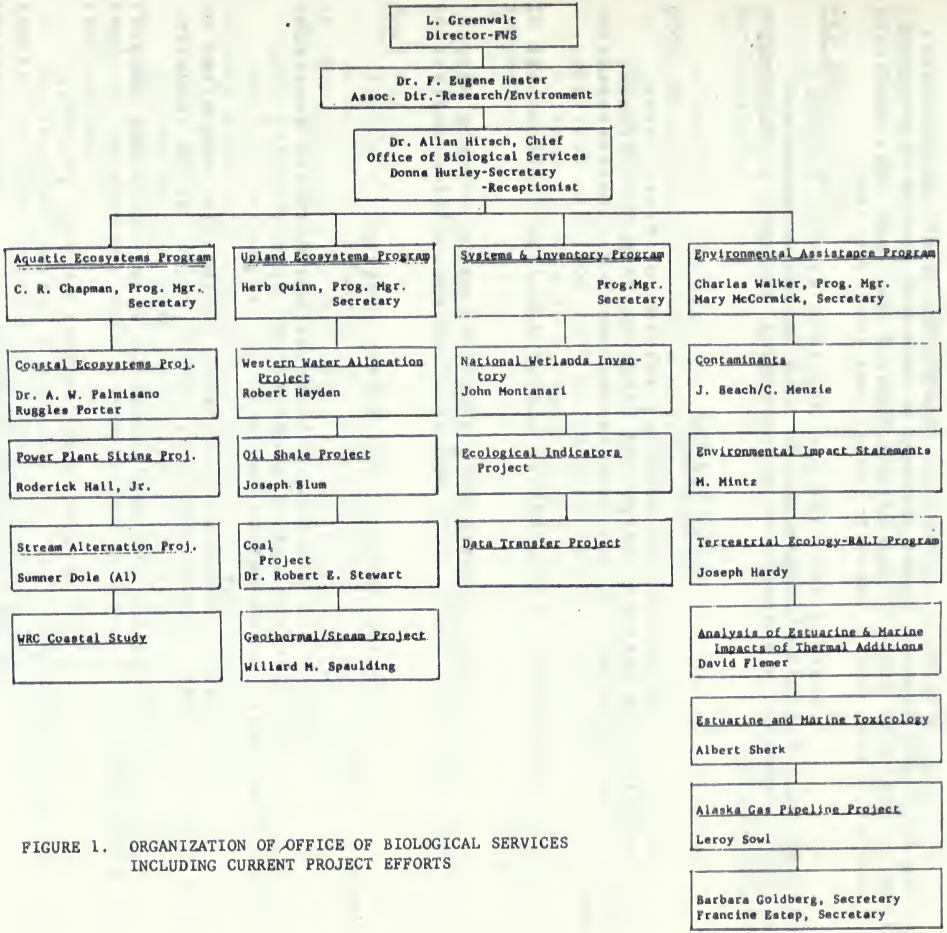

FIGURE 1. ORGANIZATION OF OFFICE OF BIOLOGICAL SERVICES INCLUDING CURRENT PROJECT EFFORTS

The bulk of our fiscal year 1975 positions are being used as follows:

1. Filling the Washington based Biological Services Headquarters staff.

2. Providing centers of scientific expertise by developing National Teams. These include a National Stream Alteration Team, a National Power Plant Siting Team, a National Coastal Ecosystems Team, and a Western Energy and Land Use Team.

3. Providing the Fish and Wildlife Service Regional Offices with Activity Leaders and in some instances Assistant Activity Leaders to address various critical elements of Regional significance.

STUDY TEAMS

We are in the process of staffing several of these Teams. Most notably, the Western Energy and Land Use Team is currently advertising for about 18 full time career service, professional positions. This Team will be located in Fort Collins, Colorado.

The broad goals of the Western Energy and Land Use Team are as follows:

1. Defining and tracking status of major western energy problems which will impact fish and wildlife and related ecological values.

2. Designing research and survey programs to attack these problems.

3. Manage and coordinate in-house and contract research dealing with wildlife/ecological problems and opportunities associated with energy development.

4. Provide technical assistance to the Fish and Wildlife Service, other Federal agencies, States, and private industry.

5. Disseminate and apply results of in-house and contract findings.

6. Assess the environmental impact of high priority national developments.

UPLAND ECOSYSTEMS PROJECTS

Within Upland Ecosystems we have a number of projects underway or being considered that have a bearing on energy development in the area of the Fort Union formation. These include the following:

Geothermal Project

Currently we have a Request for Proposal to develop ecologically sound strategies for the exploration, development, and management of geothermal resources. Interested parties must file a proposal by May 2, 1975.

Western Water Allocation Project

We have let a contract for a state-of-the-art study on methodologies for measuring in-stream water requirements of fish.

A Request for Proposal was released to obtain proposals relating to fish requirements in existing flows below dams and diversions. The due date of these proposals was May 9, 1975.

Oil Shale Project

In cooperation with other Federal agencies we are providing support for a new Soil Conservation Service Plant Materials Center in Colorado.

A contract is being let to evaluate expected environmental problems associated with a mature oil shale industry.

We are supporting a study to define wildlife/ecological parameters in areas that may be developed for oil shale.

A study to develop a computerized pattern recognition model to assess wildlife implications of oil shale development is being supported.

We are considering a study to determine the value of reverted irrigation lands for wildlife.

Coal Project

A contract is being let to study orphaned strip mined lands of different ages to determine the wildlife implications of rehabilitating these lands.

We will be supporting experimental studies in the Four Corners area to determine the effects of removing selected species on the entire ecosystem.

In conjunction with the Surface, Environment and Mining Program (SEAM) of the U.S. Forest Service, we are supporting a study to develop and test a comprehensive ecological classification scheme.

We are considering a proposal to identify native prairie tracts that are 40 acres and larger, and develop a wildlife/ecosystem based classification of prairies throughout the Northern Great Plains.

We are supporting intensive wildlife research to provide baseline habitat information in Wyoming and South Dakota, and are planning to support intensive wildlife studies on the Shell Oil site in Montana to provide baseline habitat information.

We are considering proposals for comprehensive, real world models to assess implications of coal development on wildlife.

In cooperation with the Bureau of Land Management, and the States of North Dakota and Montana we have funded a project to obtain color infrared photography of large portions of western

North Dakota and Eastern Montana that may be affected by coal development. This photography will be used as a resource base for impact assessment.

We anticipate the approval of a cooperative venture with the Environmental Protection Agency to develop four intensive study areas for remote sensing/wildlife habitat research. One of these areas will be in the Four Corners area, one in the oil shale area, and two in the area of the Fort Union formation.

THE FUTURE

In the coming fiscal year, we expect to rely heavily on the Western Energy and Land Use Team stationed at Fort Collins, Colorado, to develop a comprehensive and integrative approach to energy related wildlife problems and opportunities in the Fort Union area. This Team will define problems and develop operational and research approaches to deal with them. They will relate closely to other Federal, State, and private programs in the area in their endeavors.

CONCLUSION

In conclusion, the Biological Services Program in the Fish and Wildlife Service is brand new and deeply involved in minimizing the ecological damage of energy development. Our western energy activity involves a relatively small Washington staff, a fairly large National Team and Energy Activity Leaders in each Fish and Wildlife Service Region facing major energy development activity. A number of wildlife/ecosystem projects and studies that are relevant to the area of the Fort Union formation are underway.

Currently we are staffing a Western Energy and Land Use Team and welcome applications from qualified individuals. We anticipate the Team will fund energy related activities at a level between $2 and $3 million a year. Criteria for funding will include: baseline data, or other ecosystems information with broad regional implications; improved or new methodologies for environmental planning or impact assessment; pilot or demonstration projects with wide application: and development of critical information needs. Heavy emphasis is placed upon output oriented activities that are relevant to the decision making process.

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SYNTHETIC FUELS FROM COAL - THE ERDA/FE PROGRAM

Dr. G. Alex Mills*

WHY SYNTHETIC FUELS?

A specific, well-defined research and development program for converting coal to clean synthetic fuels is underway at an accelerated pace. This program, administered by the Energy Research and Development Administration, Fossil Energy, is in an advanced state of development. Following years of laboratory research and current pilot plant testing, this program is reaching a new stage of transition to commercial sized demonstration plant installations.

The Arab oil embargo and events since then have heightened this nation's awareness of its tenuous control over the security of its energy supplies which are so vital to its economy and way of life. The underlying trends have been developing over a period of years.

Essentially, the problem arises from major increasing energy demands on the one hand, coupled with declining and insufficient domestic fuel production. This has resulted in major increases in importation of foreign oil and projected reliance on non-fossil energy resources, many of which, like solar energy, are yet to be developed on an economic basis.

At present we are in the position of importing 40 percent of our oil, oil which is uniquely important to our transportation system. This imported oil is equivalent to 20 percent of our total energy usage. There are two different objections to this high importation level. First, if foreign oil is cut off, it would result in drastic disruption of our way of life, much greater than in the previous embargo. Secondly is the problem of the cost of foreign oil. It has already caused severe economic problems. Furthermore, the annual bill of 25 billion dollars now and more later is more than we can afford. Also it is providing for Arab purchases which we may not wish but may not be able to resist, for example, potential purchase of extensive U.S. coal deposits. Finally, there is the potential for a political cost, a bill which we can expect to be rendered at some future time. Fortunately, in the United States there is the option of manufacture of synthetic fuels from oil shale and coal.

Even with heavy reliance on conservation and a major shift to electric power, the Project Independence estimates show that synthetics will be extremely important towards the end of the century. Such contributions, however, will not be available without positive action now. This is particularly true since there is such a long lead time, at least 10 years between the decision to act and significant production of synthetic fuels.

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ERDA/FE

The Energy Research and Development Administration came into being January 19, 1975. As the name implies, this organization has the responsibility of administering the federal energy and development activities. This agency combines the former Atomic Energy Commission, except its regulatory functions, all of the Office of Coal Research, the energy activities of the Bureau of Mines including its Energy Research Centers (but not coal mining research which remains with the Bureau), and part of the National Science Foundation, most notably its former solar research activities. Not included in ERDA is the Environmental Protection Agency functions of stack gas clean-up. ERDA is organized under six assistant administrators, one of which is concerned with Fossil Energy.

OBJECTIVES AND STRATEGY

The principal objectives of the Coal Research Program are:

1. To accelerate the development of the technology for converting coal to environmentally acceptable liquid and gaseous fuels.

2. To stimulate improved methods for the direct combustion of coal.

3. To develop advanced power conversion systems utilizing higher-efficiency technologies for generating electricity from coal.

The strategy is:

Sponsor/Manage/Perform Basic Research

Cost Share Development and Demonstration of Advanced Processes.

Transfer Technology to Private Sector for Commercialization

ERDA/FE PROGRAM SUMMARY

Research and development will continue on coal liquefaction concepts to advance the technology needed for converting coal to low-sulfur, low-ash fuel oil for power generation and for upgrading to transportation fuels. Specific activities are related to the four methods of converting coal to liquids, namely direct catalytic hydrogenation, solvent extraction, pyrolysis and indirect liquefaction (from $CO + H_2$).

The coal gasification program will include research and development efforts directed toward high-Btu and low-Btu gasification processes, both above ground and in-situ. The low-Btu gasification program will produce a gas suitable for power generation and combined gas-steam turbine power cycles, thus further employing coal as a utility fuel in an economic and environmentally acceptable manner. The high-Btu coal gasification activities, a cooperative and jointly funded effort of industry-Government,

will continue technology development of processes aimed at improving the nation's natural gas resources by producing substitute pipeline quality gas at a reasonable price.

Efforts will continue on the direct combustion program to develop boiler systems capable of burning high sulfur coals of varying quality in an environmentally acceptable manner, achieve higher combustion efficiency, minimize harmful emmissions, and foster adoption of improved processes by powerplants. Research and development will also continue on advanced power conversion systems to establish the technology base for more efficient generation of electricity from coal.

Advanced research and supporting technology will provide support primarily to the liquefaction, gasification, direct combustion and advanced power systems programs in FY 1976. The principal areas of concern involve innovative improved process research, supporting technology, especially materials research, basic coal science, and systems studies.

Pilot plant efforts on a number of processes have proceeded to a point where it is planned to build a Clean Boiler Fuel demonstration plant to convert typically high-sulfur Eastern bituminous coals to an environmentally acceptable lower-sulfur boiler fuel. The FY 1976 program includes funds for the conceptual design phase for the Clean Boiler Fuel demonstration plant, initial effort in the design of the High-Btu Pipeline Gas and Low-Btu Fuel Gas demonstration plants, and technical support for all three projects.

BUDGET

The research budget is influenced by the estimate that coal utilization will have to increase by at least a factor of two by the year 1985 and that about 20 synthetic fuel plants will be on line producing a million barrels per day BTU-equivalent synthetic fuel from coal and shale by 1985. The organization and funding of energy research have responded to the increasing sense of concern.

A breakdown in funding of the Department of Interior and ERDA for various energy categories is shown in Table 1.

STATUS OF PROGRAM IMPLEMENTATION

While certain laboratory research on coal is carried out at the Energy Research Centers and at present a small amount in National Laboratories, by far the major part sponsored by ERDA is by contract in industrial, university, and institutional laboratories and industry operated pilot plants.

ADVANCED RESEARCH AND SUPPORTING TECHNOLOGY

AR&ST serves as the central research and systems studies area for all elements of fossil energy. The major objectives are these:

1. To provide support technology to assure reliable and efficient process operations.

TABLE 1
FOSSIL ENERGY R&D FUNDING SUMMARY

	FY 1974 DOI	FY 1975 ERDA	FY 1975 DOI	FY 1976 ERDA	FY 1976 DOI
COAL MINING	8.6	0	50.3	0	61.8
COAL LIQUEFACTION	46.2	107.7	0	97.6	0
HIGH BTU GASIFICATION	33.3	59.8	0	63.4	0
LOW BTU GASIFICATION	22.1	52.0	0	45.4	0
DEMONSTRATION PLANT	0	(24.0)*	0	57.0	0
DIRECT COMBUSTION	15.5	35.9	0	38.1	0
ADVANCED POWER	9.7	17.6	0	20.3	0
SST & SYSTEM STUDIES	9.9	23.3	0	35.4	0
OIL & GAS	13.4	25.5	28.3	25.7	36.5
OIL SHALE	3.3	3.0	8.6	7.0	12.6
GEOTHERMAL	3.1	0	10.1	0	12.2
URANIUM	1.5	0	10.1	0	13.5
ENERGY TRANSPORTATION & STORAGE	2.5	8.5	5.5	9.0	2.2
OTHER	2.9	0.7	40.1	2.1	30.2
	$172M	334.0	153.0	401.0	169.0
		$487M		$570M	

*FUNDING OUT OF LIQUEFACTION

2. To initiate development of new and improved coal conversion and utilization processes.

3. To assure an adequate supply of trained technical personnel.

4. To assess the development of fossil energy processes in terms of needs and economic, social, and environmental constraints and benefits.

A major new initiative during FY 1975 was a materials and component engineering program for various coal utilization processes. A supporting program on power and combustion research has begun. Research to improve synthetic fuels processes has been accelerated. In addition, a more aggressive program relating to basic coal science and engineering has been undertaken. A large part of this is carried out in a rapidly expanding program of university research.

A number of workshop conferences have been sponsored (Carnegie-Mellon, Ohio State, S. U. N. Y., U. of Scranton) which have defined research needs and recommended priorities. Copies of reports from these meetings are available and certainly have assisted us at ERDA in our program planning and also guided those making research proposals.

SYNTHETIC FUELS

The main emphasis is on developing improved, "third generation" processes. Already promising results are becoming available from contracts under way--a novel halide and other catalysts, coal to aromatics by very rapid hydroliquefaction, co-production of coke and chemicals, manufacture and separation of hydrogen, control of pollution in synthetic fuels manufacture, conversion of methanol from coal to high octane gasoline (Table 2).

MATERIALS AND COMPONENTS

The successful conversion of coal to clean fuels, and thermal and electric energy depends upon efficient and reliable plant operation. Equipment must operate at high temperatures and pressures and under hostile erosive and corrosive conditions. First, known metallic alloys and ceramic materials of construction must be tested for suitability. Special equipment such as valves and filters are needed for synthetic fuels manufacture. Also materials testing for fireside corrosion is needed, including turbines and heat exchangers to be used in operation with new synthetic fuels from coal and in operation of fluid bed combustion of coal.

UNIVERSITY RELATIONS

One primary function of the University program is to ensure that an adequate base of technical manpower is trained in coal science and technology. It is believed that this is best accomplished by awarding contracts to universities to carry on scientific work, which can have an application in an area of known need or potential improvement. Contracts usually feature both graduate students and faculty members.

TABLE 2

ADVANCED RESEARCH AND SUPPORTING TECHNOLOGY

COAL - SYNTHETIC FUELS

	APPROACH		BENEFIT
1.	FLASH HYDROCRACKING	-	AROMATIC LIQUIDS
2.	NOVEL CATALYSTS	-	DIRECT GASOLINE PRODUCTION
3.	METHANOL	-	HIGH OCTANE GASOLINE
4.	EXTRACTIVE - COKING	-	RAPID APPLICATION
5.	CATALYTIC GASIFICATION	-	LOWER REACTION TEMPERATURE & FEWER STEPS
6.	ADVANCE SOLID/LIQUID SEPARATION TECHNOLOGY	-	LOWER COST PROCESS
7.	STRUCTURE OF COAL, MECHANISMS, THERMODYNAMICS	-	GUIDE TO MAJOR IMPROVEMENTS

FIGURE 1
ERDA/FOSSIL ENERGY COAL RESEARCH PROGRAM
SUPPORT OF UNIVERSITIES
FY 1973-1976

Coal research in universities is at the $6 million level in FY 1975 and expected to be $8 million in FY 1976. In addition, work on MHD administered by universities is about $4 million at present. The distribution and rapid budget growth is shown in Figure 1.

Primary emphasis in the program continues to be directed to the application of synthetic fuels from coal. Work also involves coal science and catalysis seeking to establish a relationship between the structure of coal and its chemical reactivity. The purpose is to utilize this information to guide the discovery of new and improved processes for more efficient operation.

At the end of FY 1975 we expect to have 40 contracts in about 30 states.

COAL LIQUEFACTION

The primary objective of coal liquefaction research is to provide technology which is economically feasible and environmentally satisfactory to convert coal to a clean liquid fuel for electric power generation, transportation, and heating for industry and houses.

The short term strategy is to develop to an industrial scale the conversion of coal into a low-sulfur, low-ash fuel oil suitable for electric power generation. This will release for other uses petroleum and natural gas. The longer term objective is to develop technology for production of gasoline, methanol, diesel fuel, and heating oil and chemical feedstocks.

The objective and specific 1975 targets are summarized in Table 3.

TABLE 3
COAL LIQUEFACTION

OBJECTIVE

DEMONSTRATION PLANT SCALE: COAL LIQUEFACTION

FY 75 TARGETS:

8 T/D SYNTHOIL PROCESS DEVELOPMENT UNIT (PDU)

DESIGN CO-STEAM PDU

DESIGN H-COAL PILOT PLANT

SRC - COMPLETE DESIGN ANALYSIS

ISSUE "CLEAN BOILER FUEL" DEMOPLANT CONTRACT

FY 75 APPROPRIATION: - $107M

HIGH BTU GAS

The co-operative effort to provide improved technology for the manufacture of pipeline gas from coal sponsored by the American Gas Association and the federal government is now entering the final developmental phase. Four large pilot plants are or will be in operation in 1975. The Synthane pilot plant is scheduled to begin coal feeding in late May 1975. Several large process development units are under construction. The large stirred-fixed bed at the Morgantown Energy Research Center is in operation.

The most promising process or combination of process steps will be used to design a demonstration plant. To initiate this important step, it is planned to issue a "request for proposal" in mid 1975 to design, construct and operate a high Btu demonstration plant, to be equally funded and managed by industry and the federal government. The high Btu gas program, discussed previously extensively, is summarized in Table 4.

TABLE 4
HIGH-BTU GAS

OBJECTIVE:

DEVELOP TECHNOLOGY TO PRODUCE HIGH BTU GAS

FY 75 TARGET:

CONTINUE HYGAS AND CO_2 ACCEPTOR PROCESSES

COMPLETE PILOT PLANT FOR STEAM-IRON

COMPLETE PILOT PLANT FOR LIQUID PHASE METHANATION

COMPLETE PILOT PLANT FOR SELF-AGGLOMERATING PROCESSES

DESIGN PDU FOR HYDRANE PROCESS

COMPLETE SYNTHANE AND BI-GAS PILOT PLANTS

STUDY NUCLEAR PROCESS HEAT

LOW BTU GAS

The objective of the low-Btu gas program is to develop one or more coal gasification systems which are applicable for power generation and industrial use. In order to compress the time required and to develop a suitable gasification system, several feasible concepts are being tested concurrently. One interesting project involves underground or in-situ coal gasification being carried out on an industrial scale near Hanna, Wyoming. During the past year, several major pilot plant projects have been initiated on a cost-sharing basis with industry.

CONCLUDING REMARKS

Insofar as coal research sponsored by ERDA in the general geographic area of this meeting, it is interesting that the following projects are active:

North Dakota

Project Lignite - University of North Dakota, conversion of lignite to premium fuels - $3,356,000

- Grand Forks Energy Research Laboratory (ERDA - $1,400,000 annual)

Montana

Montana Energy and MHD Research and Development Instituate - $1,700,000 (Montana Institute of Technology and Montana State University)

- Contracts for catalytic hydrogenation of coal derived liquids (Montana State University) and Environmental Effects from Leaching Coal Converson Byproducts (University of Montana)

Wyoming

Laramie Energy Research Center (ERDA), including underground coal gasification - $5,000,000 annual

South Dakota

Rapid City - CO_2 acceptor coal gasification pilot plant - $19,336,000 (ERDA), $3,300,000 (AGA)

There are a number of important research areas which are also an integral part of the ERDA Research program. These include minimizing water usage, prevention of pollution in the manufacture of synthetic fuels, and systems analyses including evaluation of economic and social factors.

It is believed that the program presented represents a balanced program at an accelerated but orderly pace, with the strategy of simultaneously developing promising technology in parallel, a program consistent with the timetable to make available the technology for production of a million barrels of oil per day BTU equivalent of energy from coal.

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